ELECTRICAL SERVICE MANUAL WHEEL HORSE

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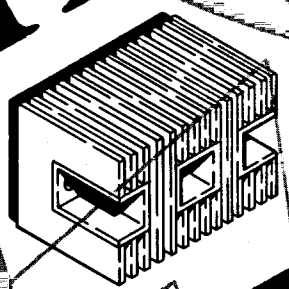
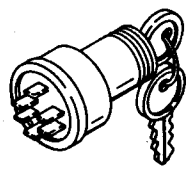
ELECTRICAL SERVICE MANUAL

REGULATOR

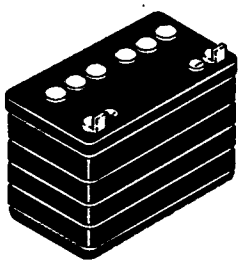
RECTIFIER



SWITCH



BATTERY



WHEEL HORSE
lawn & garden tractors

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INTRODUCTION

This manual covers A and B-Series 1980-83 and C-Series 1978-83 Tractors. For 1984 and later tractors, refer to Section 18 in Parts and Service manuals for electrical components and wiring diagrams.

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SECTION I - BATTERY

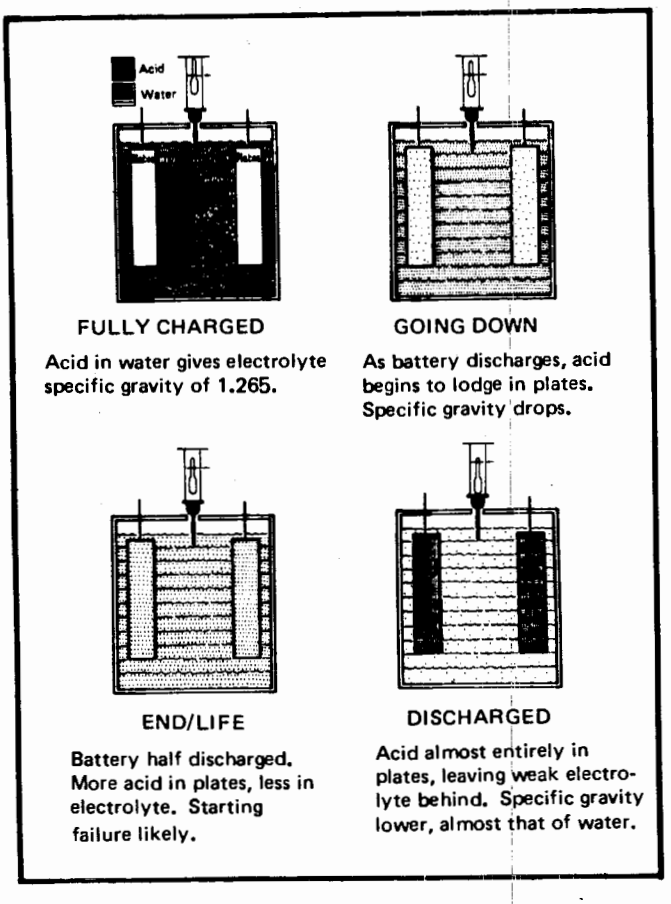
HOW IT WORKS -

A battery produces electricity as the result of a chemical reaction.

The sulfuric acid in the electrolyte combines with the positive and negative plates to form a new chemical compound called lead sulfate.

The amount of sulfuric acid consumed by the plates is proportional to the amount of electricity produced. Therefore, the more electricity produced the less sulfuric acid remains in the electrolyte.

The gradual weakening of the electrolyte lets us measure, with a hydrometer, the amount of unused acid in the water, and thus how much potential energy is left.


Acid
Water
FULLY CHARGED
Acid in water gives electrolyte specific gravity of 1.265.
GOING DOWN
As battery discharges, acid begins to lodge in plates. Specific gravity drops.
END/LIFE
Battery half discharged. More acid in plates, less in electrolyte. Starting failure likely.
DISCHARGED
Acid almost entirely in plates, leaving weak electrolyte behind. Specific gravity lower, almost that of water.

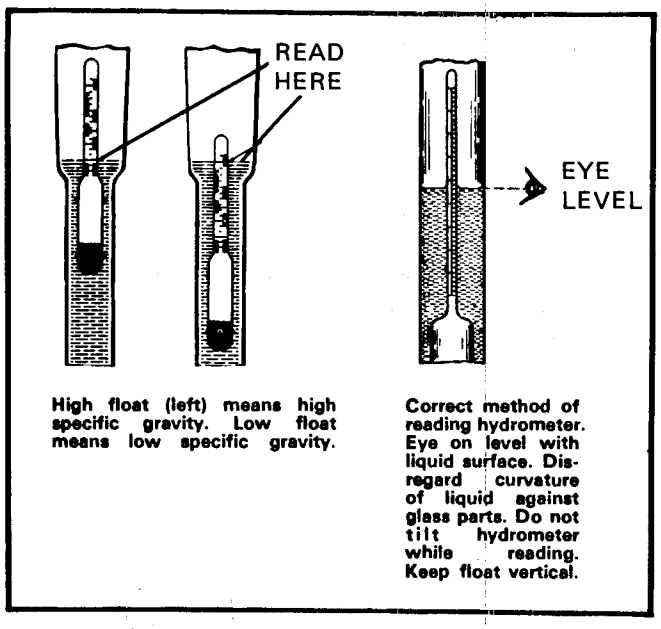
BATTERY CHEMISTRY

HOW TO USE A HYDROMETER -

The hydrometer is a direct-reading instrument used to measure the specific gravity (Spg). In reading a hydrometer, the barrel must be held vertically. To apply the test it is only necessary to draw a sample of electrolyte from a cell and jiggle the hydrometer to be sure the indicator is floating free and record the indicated Spg. DO NOT MAINTAIN LIQUID LEVEL IN THE HYDROMETER BY SQUEEZING THE BULB AS THIS GIVES INACCURATE READINGS. The float should not touch any part of the barrel.

A full charge battery equals 1.265 specific gravity (Spg) unless otherwise specified. Replace battery if there is 50 (0.050) or more points variation between highest and lowest cell.

Spg. varies with temperature, so for correct readings the electrolyte temperature should be at 60°F or higher.


READ
HERE
EYE
LEVEL
High float (left) means high specific gravity. Low float means low specific gravity.
Correct method of reading hydrometer. Eye on level with liquid surface. Disregard curvature of liquid against glass parts. Do not tilt hydrometer while reading. Keep float vertical.

READING HYDROMETER

HOW TO PREPARE A DRY CHARGED BATTERY FOR SERVICE -

A. Remove vent caps. Remove or destroy any sealing device which may have been used to close or restrict the vent openings.

B. Fill each cell of the battery with 1.265 specific gravity electrolyte to the proper level. Note: Temperature of battery and electrolyte at time of filling should be above 60°F. Never fill battery in the vehicle.

C. Fill with electrolyte until it becomes visible at bottom of filling tube.

D. Allow battery to stand for 15 minutes at room temperature before charging.

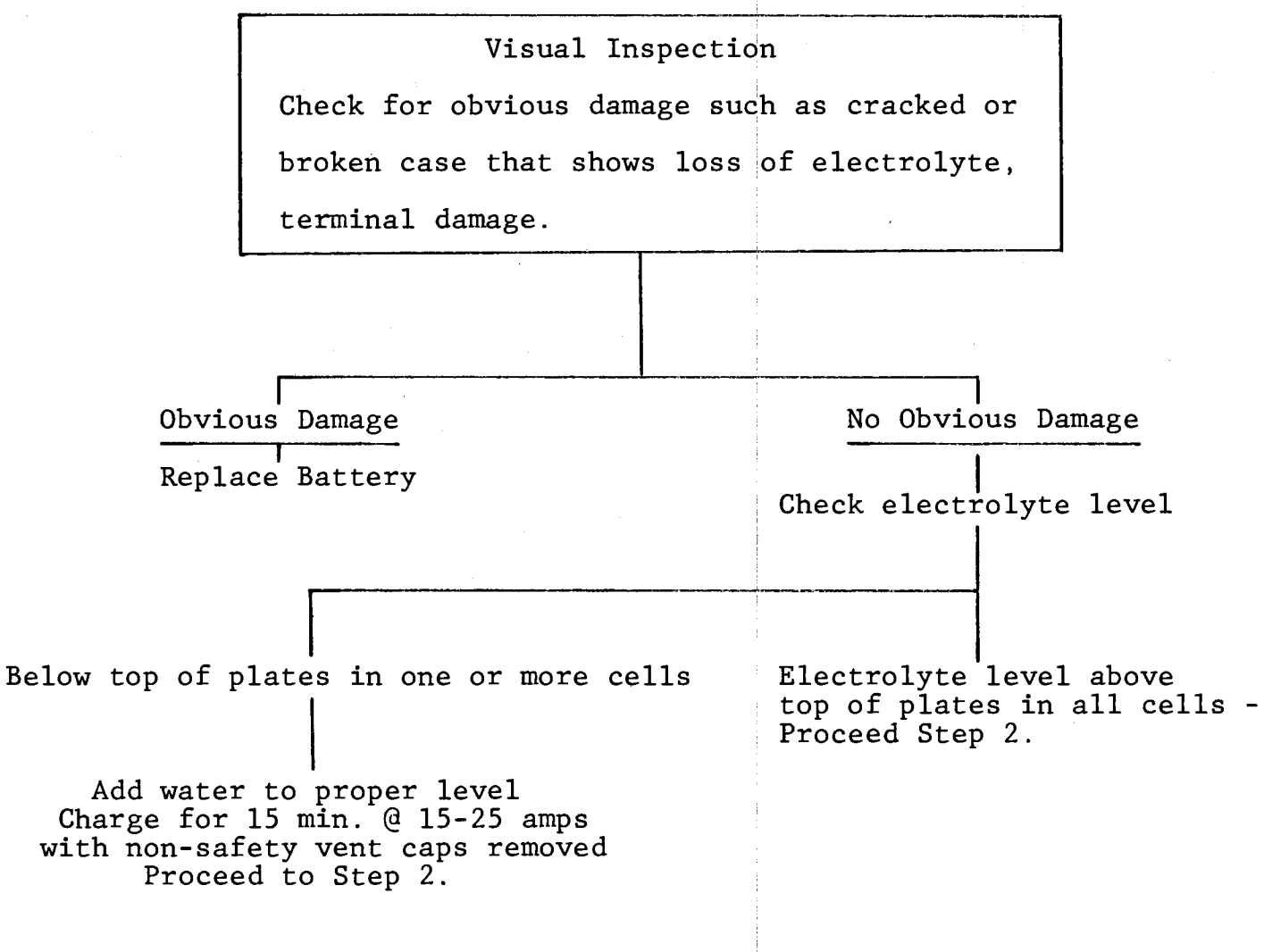
E. Place on charger for 10 minutes at a 15 amp rate. If a fast rate charger is not available charge for one half hour at a 7 amp rate.

F. After charging, check acid levels in all cells and fill with acid to the top of split ring ledge.

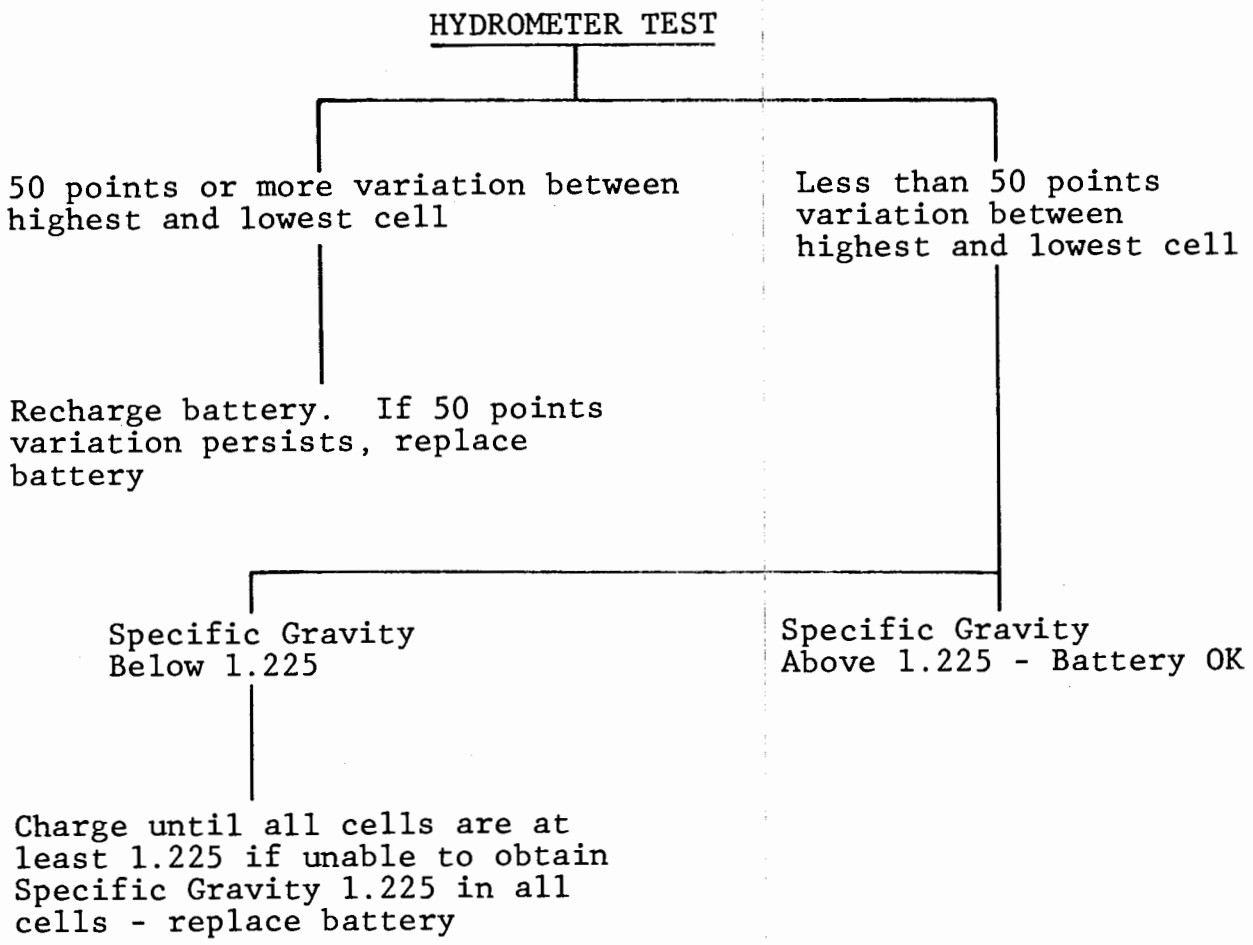
G. Install battery in the vehicle. Remember, always connect the negative terminal last. After battery has been placed in service add only water. Do not add acid.

PROCEDURE FOR TESTING BATTERIES

STEP 1


Visual Inspection
Check for obvious damage such as cracked or broken case that shows loss of electrolyte, terminal damage.
Obvious Damage
Replace Battery
No Obvious Damage
Check electrolyte level
Below top of plates in one or more cells
Add water to proper level
Charge for 15 min. @ 15-25 amps
with non-safety vent caps removed
Proceed to Step 2.
Electrolyte level above top of plates in all cells - Proceed Step 2.

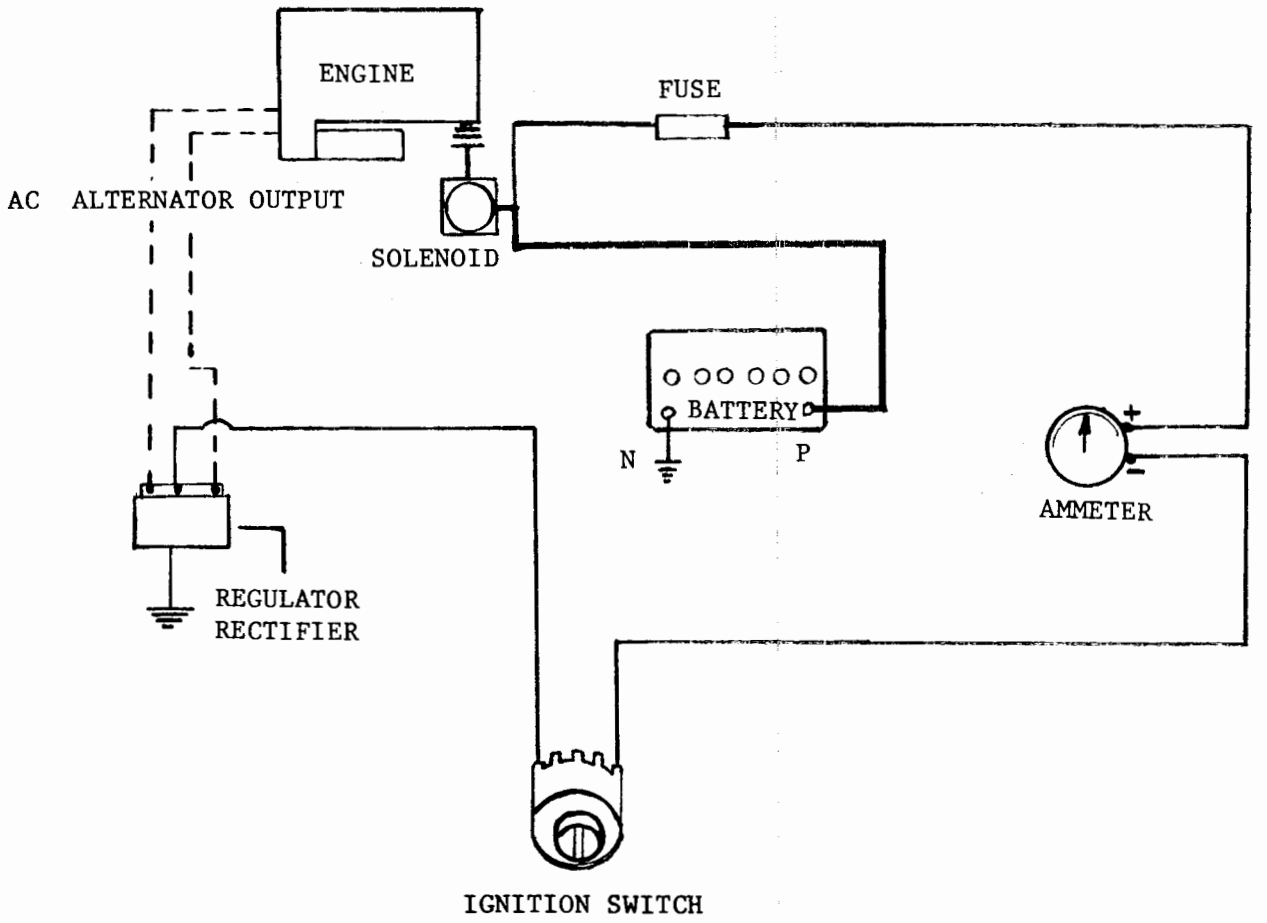
STEP 2


HYDROMETER TEST
50 points or more variation between highest and lowest cell
Less than 50 points variation between highest and lowest cell
Recharge battery. If 50 points variation persists, replace battery
Specific Gravity Below 1.225
Specific Gravity Above 1.225 - Battery OK
Charge until all cells are at least 1.225 if unable to obtain Specific Gravity 1.225 in all cells - replace battery

SECTION II - CHARGING SYSTEM

ALTERNATOR CHARGING SYSTEMS - KOHLER - ONAN ENGINES

The alternator system provides electrical energy to charge the battery and for operation of accessory circuits. A solid state rectifier-regulator is mounted externally on the engine or on the equipment powered by the engine. The system also includes an alternator-stator and permanent magnet ring inside the flywheel. With the exception of the magnet ring which revolves around the stator, these systems have no moving parts and are therefore virtually service free -- the only required service is an occasional check to make sure that all electrical connections are tight and that wires are not frayed or cracked.



TROUBLE SHOOTING - 15 AMP SYSTEM
TEST WITH ENGINE RUNNING AT 3400 RPM - NO LOAD

Condition: No Charge to Battery

Test A - With B+ cable connected, check B+ (at terminal on rectifier-regulator) to ground with DC volt meter. If 13.8 volts or higher, place minimum load of 5* amps on battery to reduce voltage:

	Possible Fault/Remedy
A-1 - If charge rate increases	A-1 - Indicates alternator System OK, battery was fully charged
A-2 - If charge rate does not increase	A-2 - Check for defective stator, or rectifier-regulator (Test B)

Test B - Unplug leads at rectifier - regulator, connect VOM (Multimeter) across AC leads, check AC voltage

	Possible Fault/Remedy
B-1 - If less than 28 volts	B-1 - Defective stator, replace.
B-2 - If more than 28 volts	B-2 - Defective rectifier-regulator; replace with new unit.

Condition: Battery Continuously Charges at High Rate

Test C - Check B+ to ground with DC volt meter

	Possible Fault/Remedy
C-1 - If over 14.7 volts	C-1 - Rectifier-regulator not functioning properly. Replace.
C-2 - If under 14.7	C-2 - Alternator system OK. Battery unable to hold charge. Check specific gravity of battery. Replace if necessary.

*Turn lights on or simulate load by placing a 2.5 OHM 100 Watt resistor across battery terminals.

Briggs & Stratton Alternator Systems

A & RR-Series electric start engines have a single DC output alternator used for battery charging only. The dual circuit alternator used on B, LT & GT-Series and some C-Series tractors is actually two separate alternators. A single ring of magnets inside the flywheel supplies the magnetic field for both of them. One alternator uses a solid state rectifier and provides battery charging current. The other alternator feeds alternating current directly to the lights. Since the two are electrically independent, use of the lights does not reduce the charge entering the battery.

Current for the lights is available as long as the engine is running. The output depends upon the engine speed, so the brightness of the light changes with the engine speed.

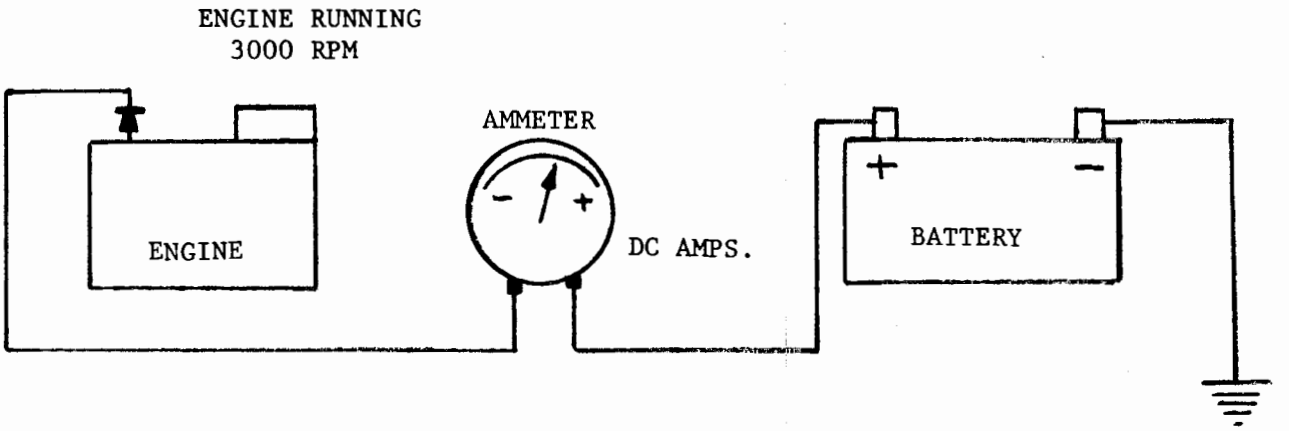
The current from the battery charging alternator is unregulated and is rated at 3 amps. The output rises from 2 amps at 2400 RPM to 3 amps at 3600 RPM, and uses less than .2 of a horsepower.

There is one external connection. The battery charging current connection is made through one terminal of a two connector plug. Current for lights is available at the second terminal of this plug. The plug is polarized to prevent improper connections. The return circuit for both alternators is through ground to the engine block.

1. Checking Dual Circuit Alternator

   A. Testing Alternator Charging Output

      Install an ammeter in Series with charging lead. Start engine. Ammeter should indicate output. The charge range is dependent upon the condition of the battery. If ammeter shows no charge, or shows a discharge, test stator and diode.



B. Testing for Short in Alternator System

Disconnect charging lead from battery, and connect charge lead test lamp in Series between battery and charge lead. DO NOT START ENGINE. Test lamp should not light. If it does light, stator charging lead is shorted or diode is defective. Disconnect charge lead connector at alternator. If test light does not go out, the wire leading back to the battery is shorted. If light goes out, diode is defective. (See section for testing diode).

C. Testing Diode

Disconnect charge lead plug from charge lead. Using multimeter set on resistance scale, check diode by attaching one meter lead to red stator lead wire (a needle may be used to pierce stator lead wire insulation). Touch the other multimeter lead to diode pin in plastic connector, then reverse meter leads. The meter should show continuity in one direction only. If meter shows a reading in both directions or does not show continuity in either direction, the diode is defective and must be replaced.

D. Testing Stator Charging Coils

Remove blower housing, flywheel etc. and examine red lead wire for cuts, damaged insulation or obvious short on leads; if bare spots cannot be repaired replace stator. Stator should also be checked for continuity as follows:

Use multimeter set on resistance scale. Touch one meter lead to stator laminations, touch the other meter lead to red stator charge lead wire. (Pierce red wire insulation with a needle to insure meter lead contact). Meter should show continuity.

Next remove screw which attaches stator ground wires to stator laminations, Be certain ground wire does not touch laminations and repeat previous test. Meter should not show continuity. If meter does not show continuity in first test or shows continuity during second test, stator is defective and must be replaced.

Note: Discoloration of stator coils does not mean stator is defective. A shorted diode will pass battery current through stator coils to ground, which discolors coils due to heat. Replacing diode would normally restore alternator without replacing stator.

Tecumseh 7 Amp Regulated Charging System (LT-1032)

The Tecumseh 7 amp charging system is similar to the 15 amp system used on Kohler and Onan engines. Follow the test procedure for these engines, with the following exceptions:

Test B - AC voltage value should be at least 21 VAC. The blower shroud must be removed, the rectifier/regulator moved to place it outside the housing, and the blower housing reinstalled to make this test.

Test C - Do not perform this test. If AC voltage check is OK and battery is not being charged, replace the rectifier/regulator.

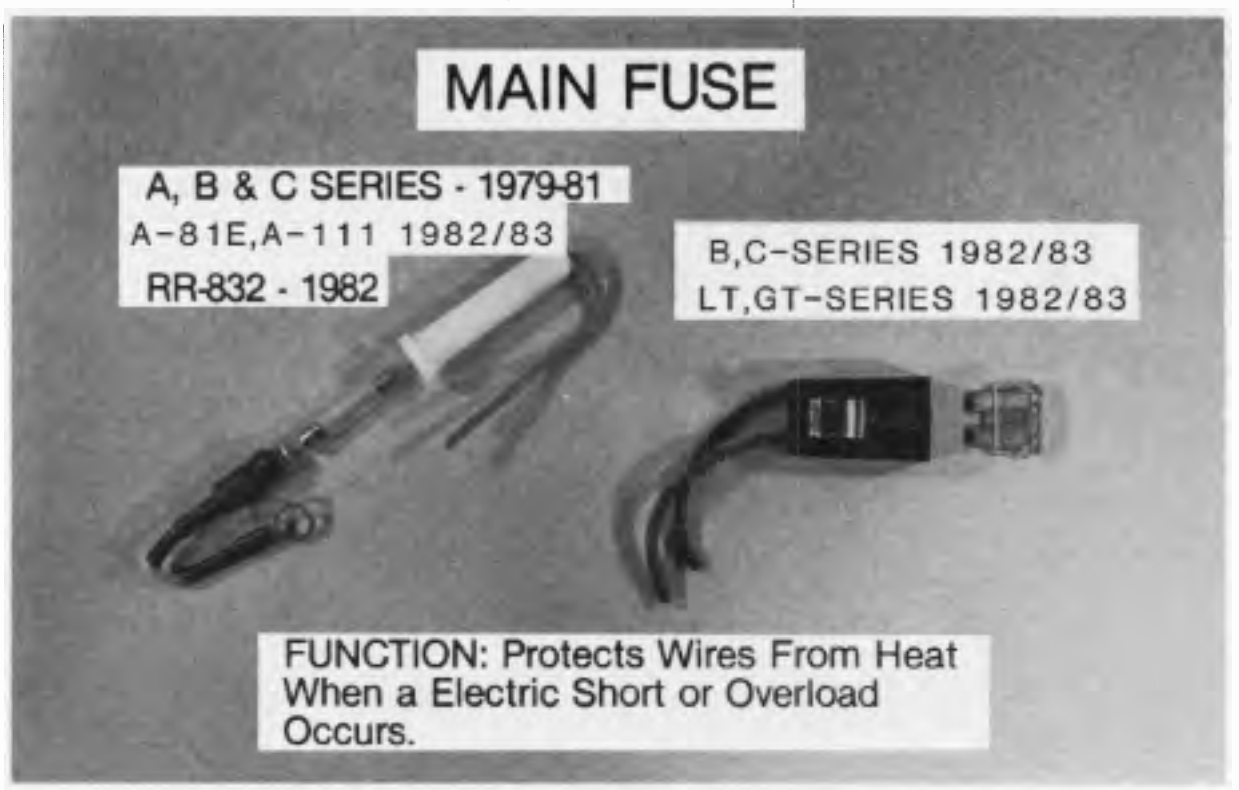

MAIN FUSE
A, B & C SERIES - 1979-81
A-81E,A-111 1982/83
RR-832 - 1982
B,C-SERIES 1982/83
LT,GT-SERIES 1982/83
FUNCTION: Protects Wires From Heat When a Electric Short or Overload Occurs.

Fig. 1

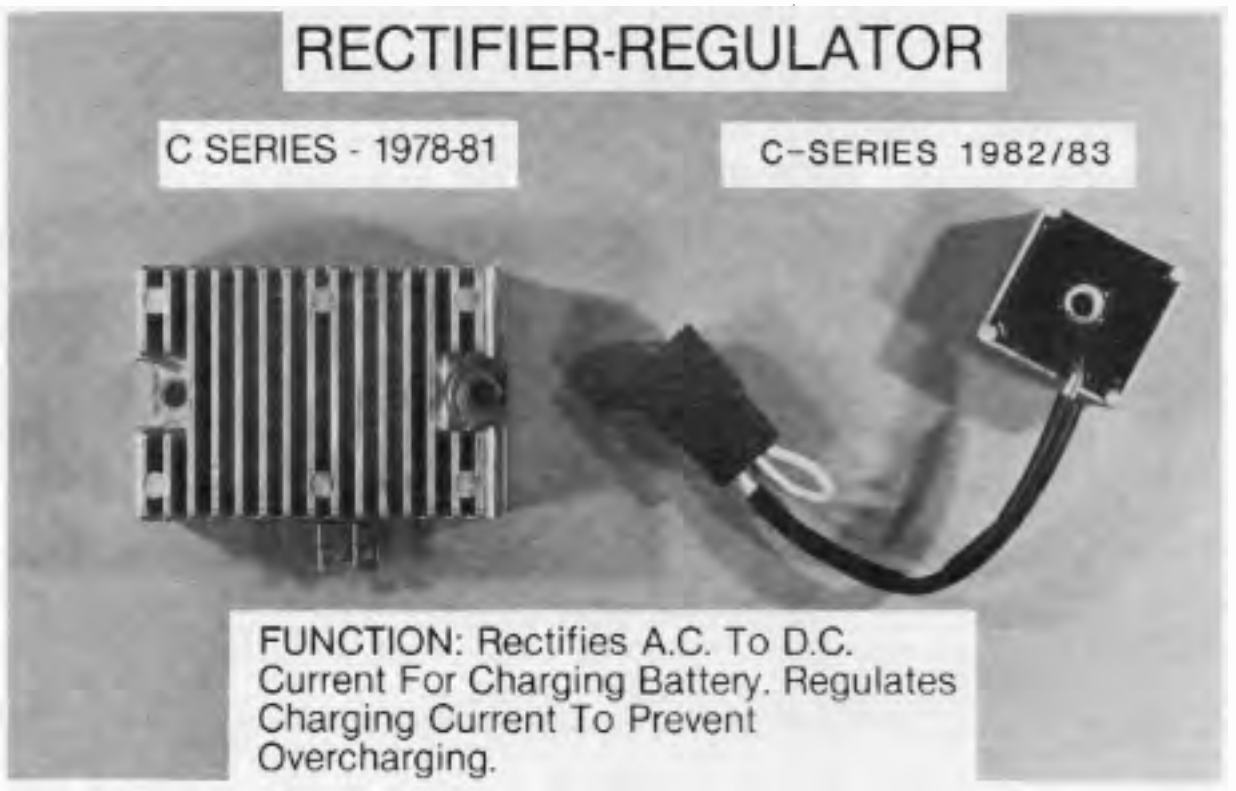

RECTIFIER-REGULATOR
C SERIES - 1978-81
C-SERIES 1982/83
FUNCTION: Rectifies A.C. To D.C. Current For Charging Battery. Regulates Charging Current To Prevent Overcharging.

Fig. 2

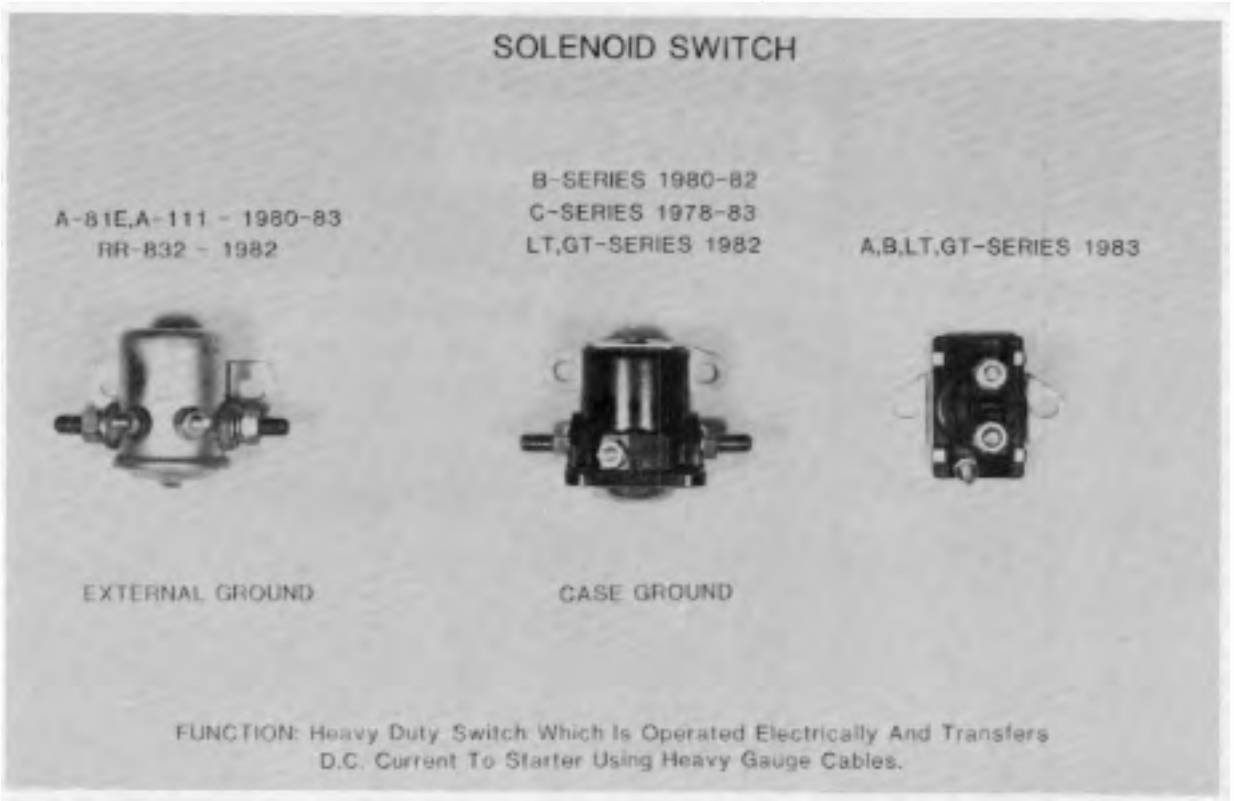

SOLENOID SWITCH
A-81E,A-111 - 1980-83
RR-832 - 1982
B-SERIES 1980-82
C-SERIES 1978-83
LT,GT-SERIES 1982
A,B,LT,GT-SERIES 1983
EXTERNAL GROUND
CASE GROUND
FUNCTION: Heavy Duty Switch Which Is Operated Electrically And Transfers
D.C. Current To Starter Using Heavy Gauge Cables.

Fig. 3

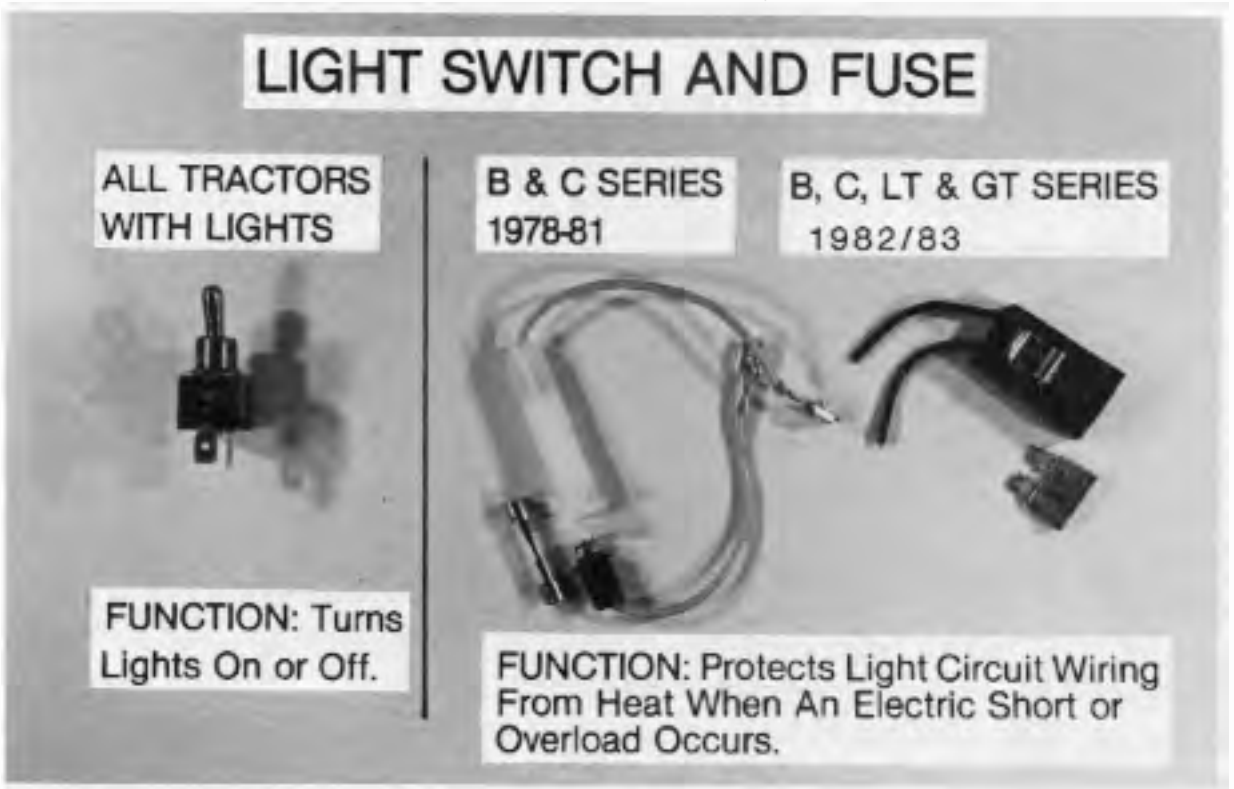

LIGHT SWITCH AND FUSE
ALL TRACTORS
WITH LIGHTS
FUNCTION: Turns
Lights On or Off.
B & C SERIES
1978-81
B, C, LT & GT SERIES
1982/83
FUNCTION: Protects Light Circuit Wiring
From Heat When An Electric Short or
Overload Occurs.

Fig. 4

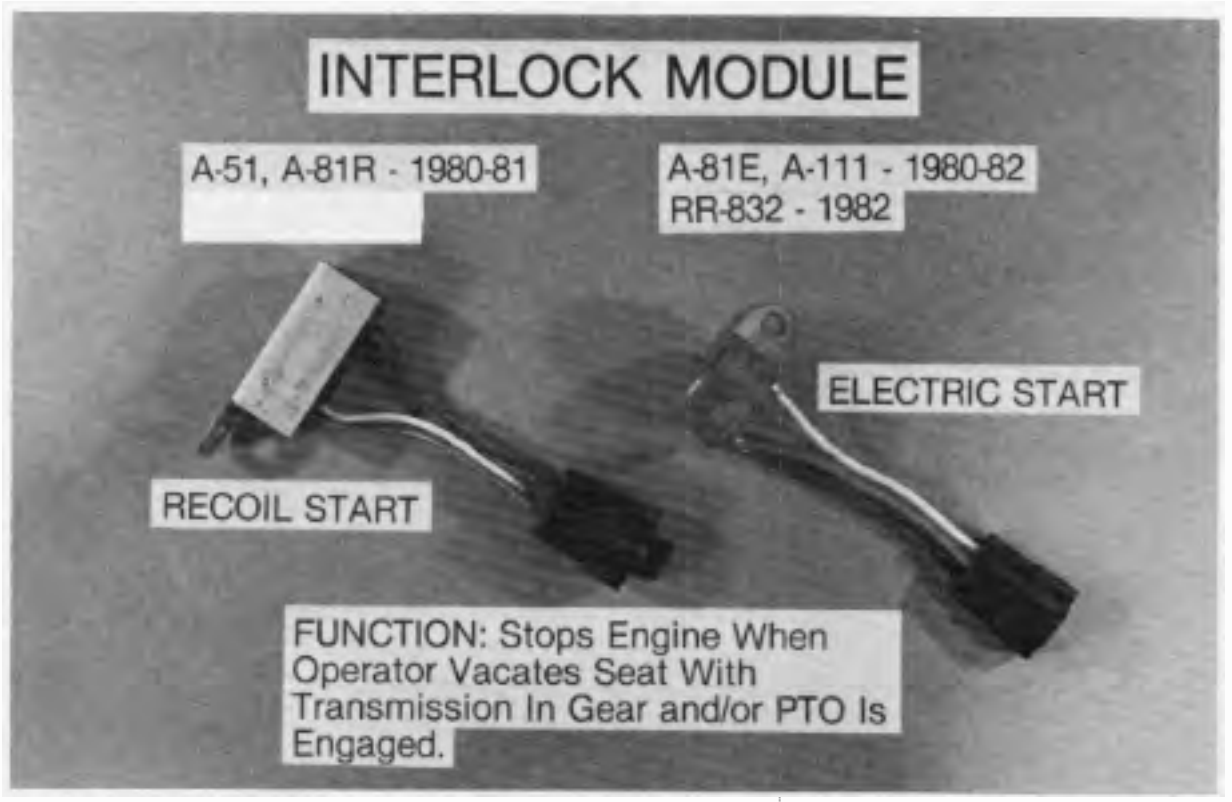

INTERLOCK MODULE
A-51, A-81R - 1980-81
A-81E, A-111 - 1980-82
RR-832 - 1982
ELECTRIC START
RECOIL START
FUNCTION: Stops Engine When Operator Vacates Seat With Transmission In Gear and/or PTO Is Engaged.

Fig. 5

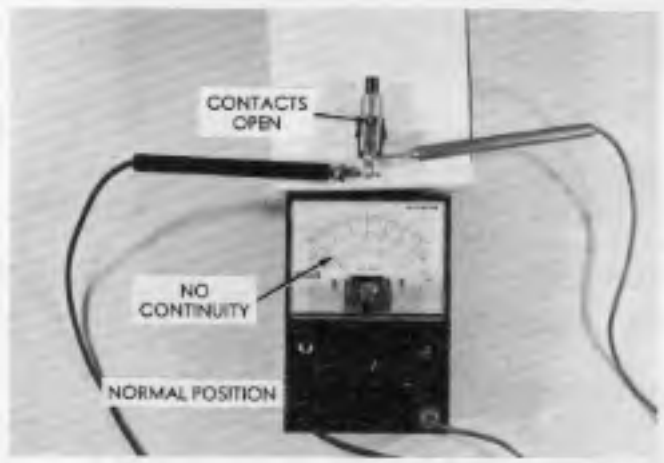


Fig. 6 Normally open (N/O) Switch

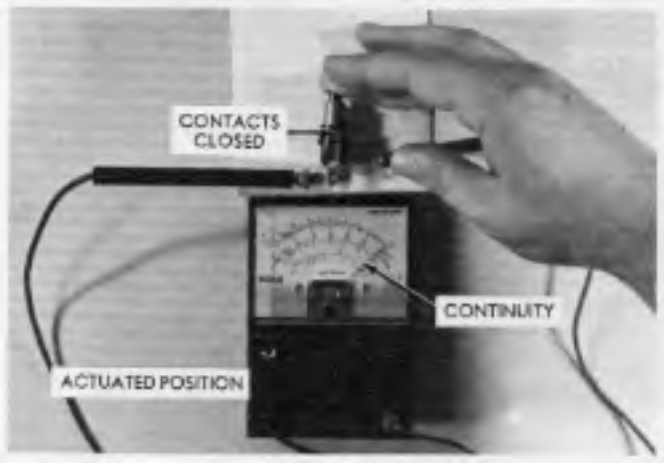


Fig. 7 Normally open (N/O) Switch

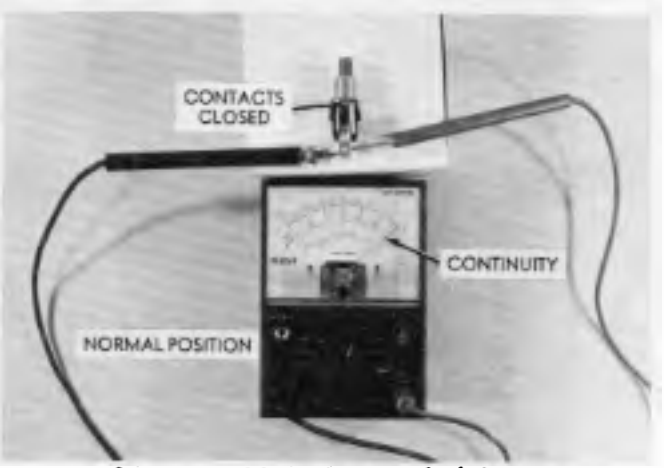


Fig. 8 Normally closed (N/C) Switch

Fig. 9 Normally closed (N/C) Switch

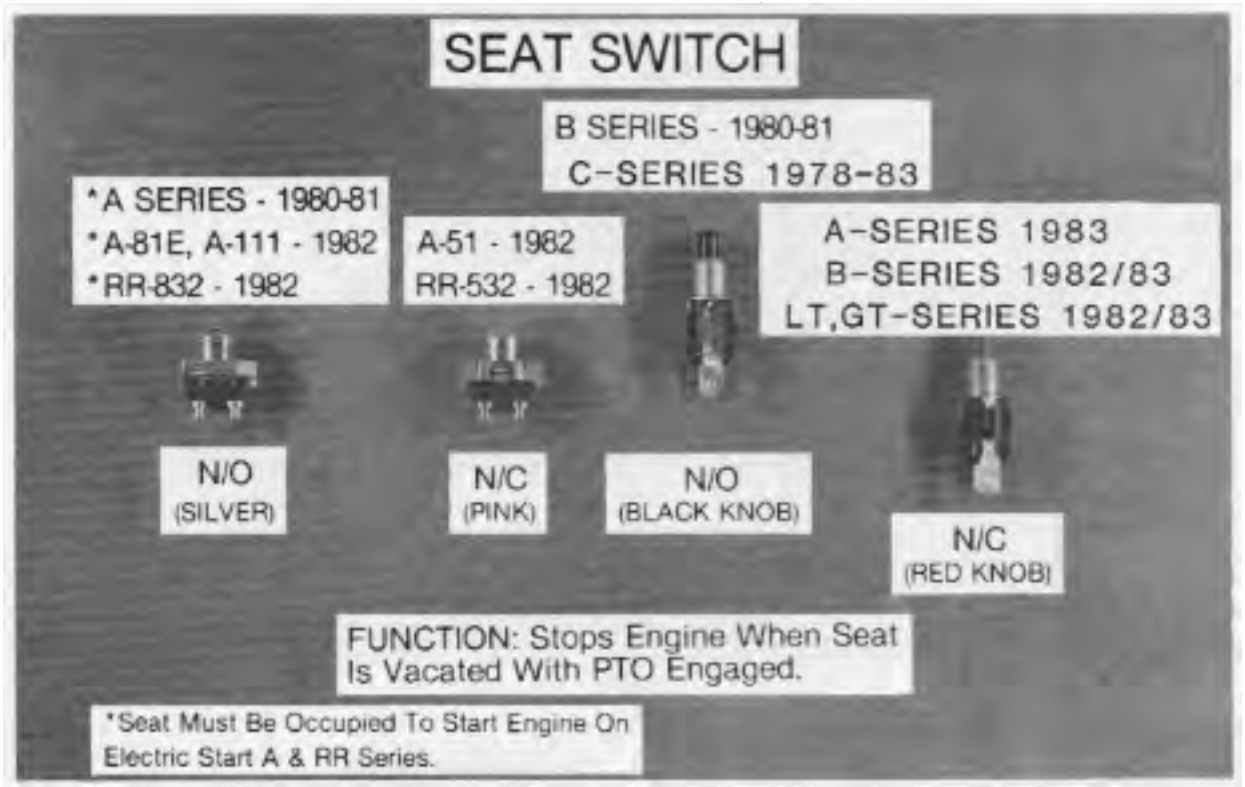

SEAT SWITCH
B SERIES - 1980-81
C-SERIES 1978-83
*A SERIES - 1980-81
*A-81E, A-111 - 1982
*RR-832 - 1982
A-51 - 1982
RR-532 - 1982
A-SERIES 1983
B-SERIES 1982/83
LT,GT-SERIES 1982/83
N/O
(SILVER)
N/C
(PINK)
N/O
(BLACK KNOB)
N/C
(RED KNOB)
FUNCTION: Stops Engine When Seat
Is Vacated With PTO Engaged.
*Seat Must Be Occupied To Start Engine On
Electric Start A & RR Series.

Fig. 10

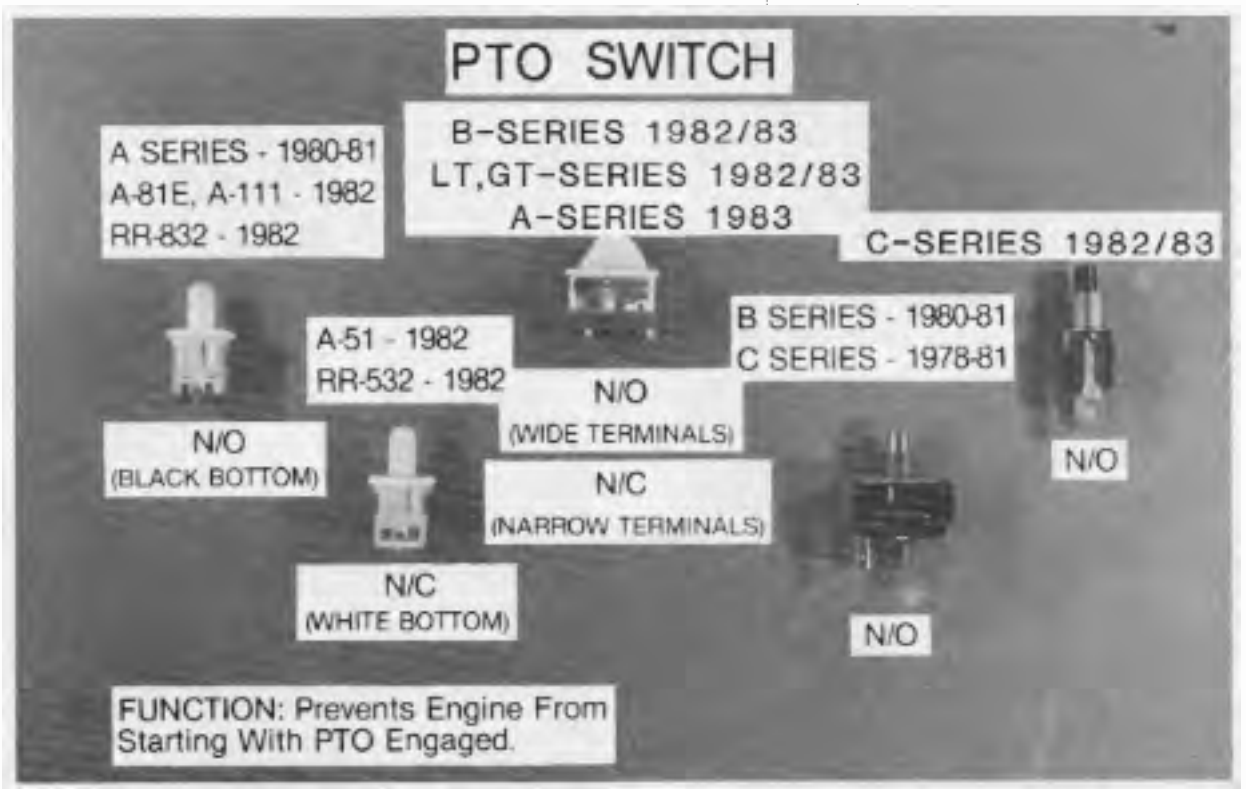

PTO SWITCH
A SERIES - 1980-81
A-81E, A-111 - 1982
RR-832 - 1982
B-SERIES 1982/83
LT,GT-SERIES 1982/83
A-SERIES 1983
C-SERIES 1982/83
A-51 - 1982
RR-532 - 1982
N/O
(WIDE TERMINALS)
B SERIES - 1980-81
C SERIES - 1978-81
N/O
(BLACK BOTTOM)
N/C
(NARROW TERMINALS)
N/O
N/C
(WHITE BOTTOM)
N/O
FUNCTION: Prevents Engine From
Starting With PTO Engaged.

Fig. 11

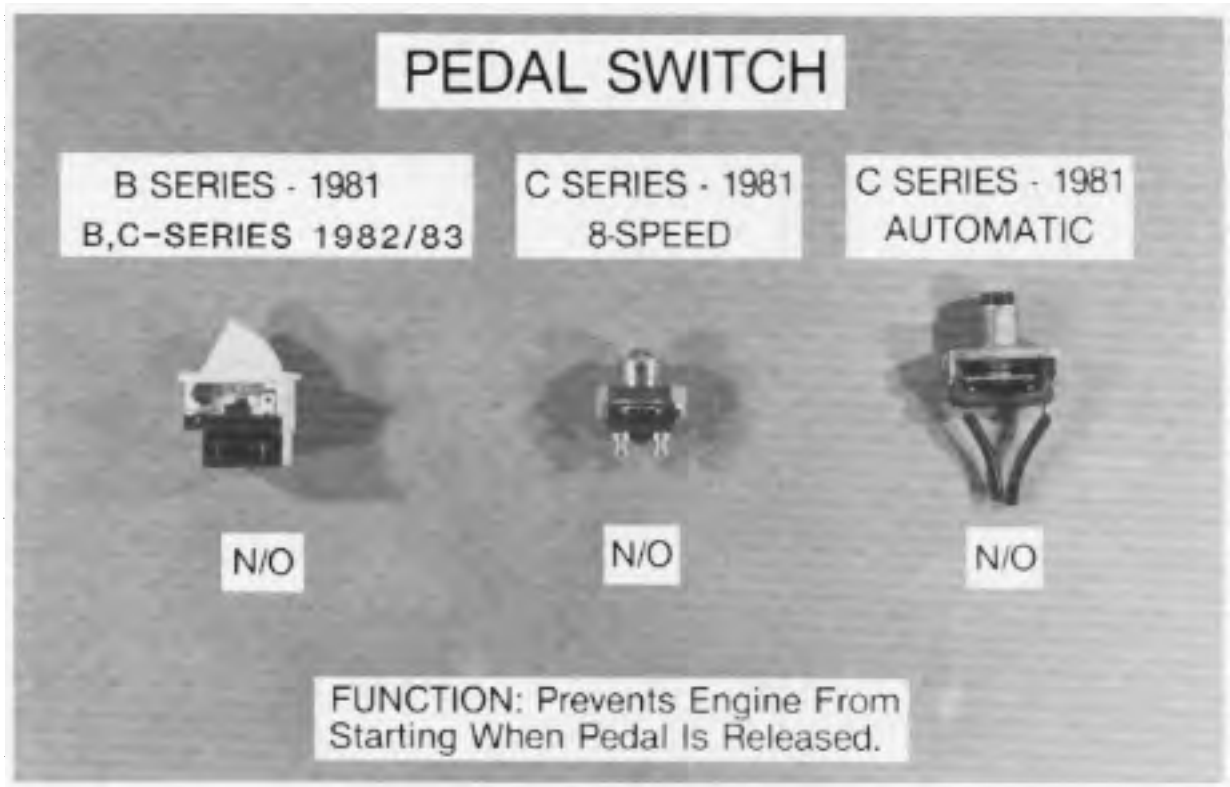

PEDAL SWITCH
B SERIES - 1981
B,C-SERIES 1982/83
C SERIES - 1981
8-SPEED
C SERIES - 1981
AUTOMATIC
N/O
N/O
N/O
FUNCTION: Prevents Engine From
Starting When Pedal Is Released.

Fig. 12

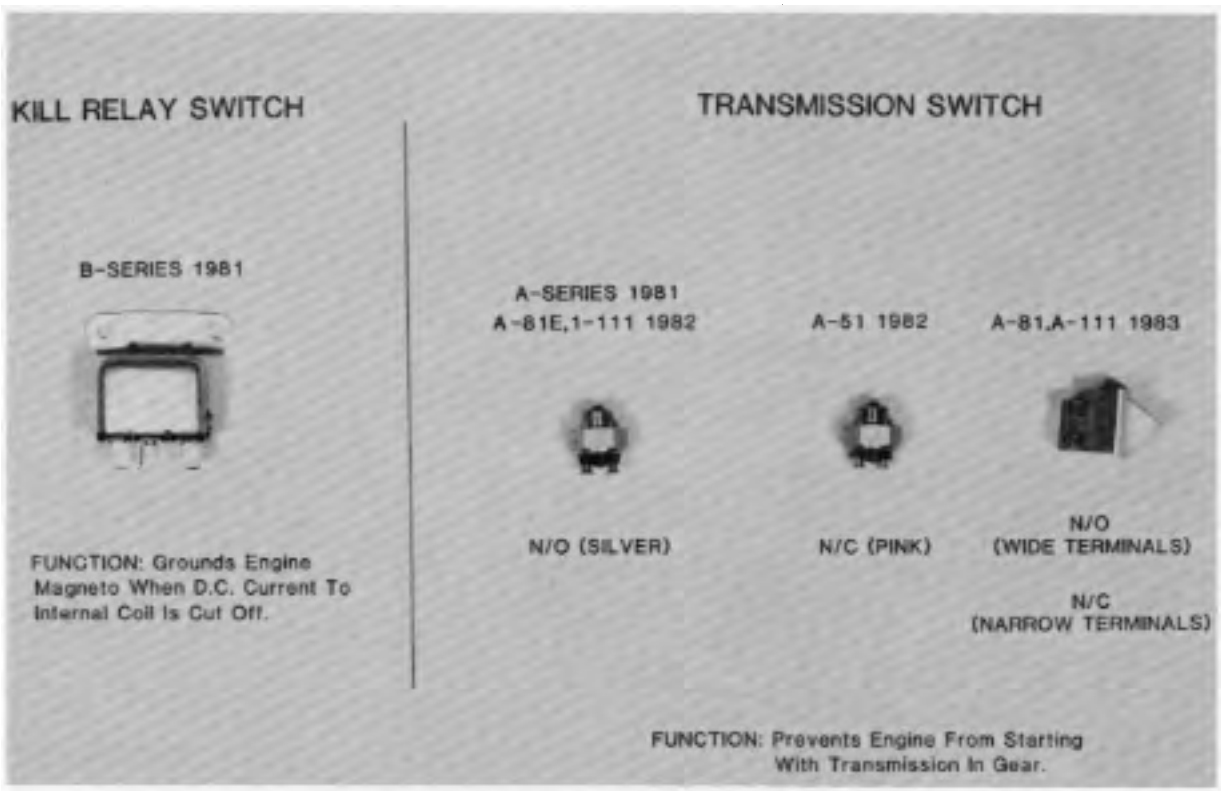

KILL RELAY SWITCH
B-SERIES 1981
FUNCTION: Grounds Engine
Magneto When D.C. Current To
Internal Coil Is Cut Off.
TRANSMISSION SWITCH
A-SERIES 1981
A-81E,1-111 1982
A-51 1982
A-81,A-111 1983
N/O (SILVER)
N/C (PINK)
N/O
(WIDE TERMINALS)
N/C
(NARROW TERMINALS)
FUNCTION: Prevents Engine From Starting
With Transmission In Gear.

Fig. 13

WIRING DIAGRAM — 1981 A-51 and A-81R RECOIL START RIDER

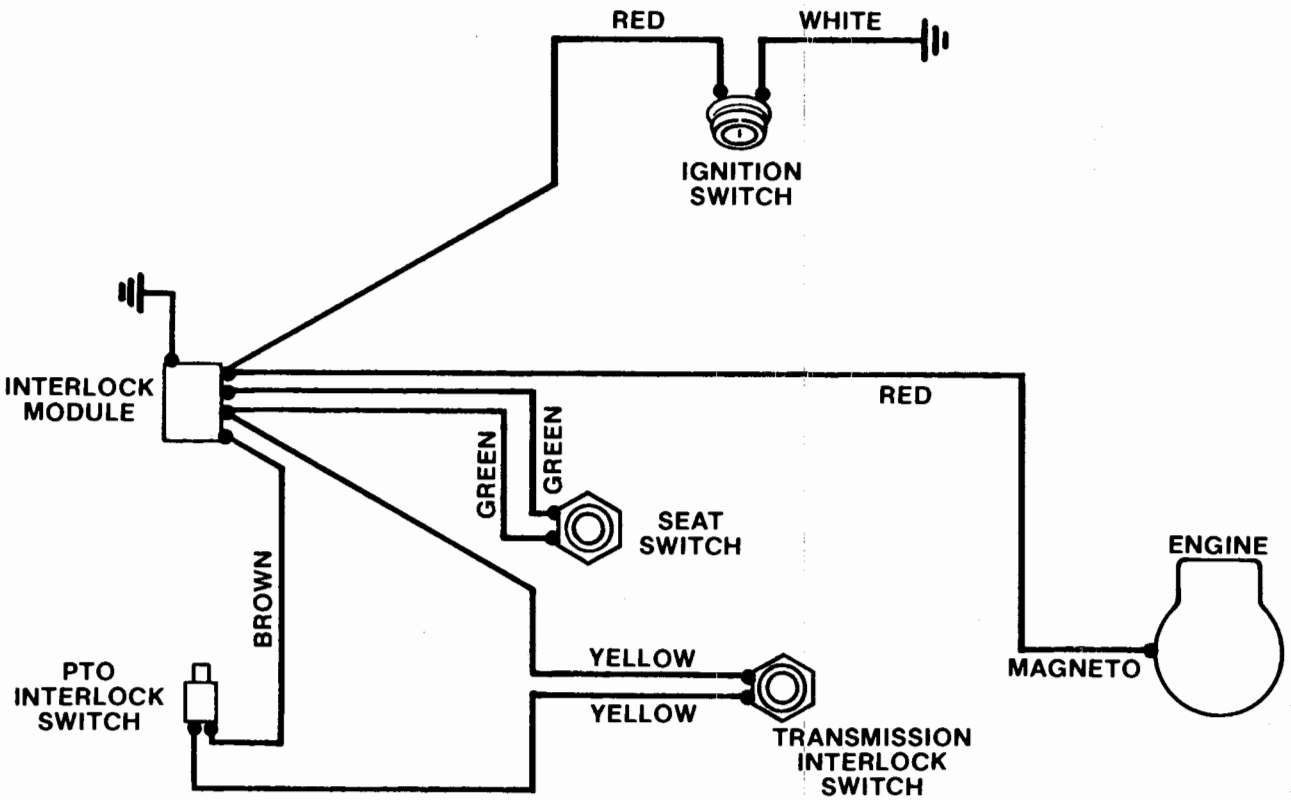
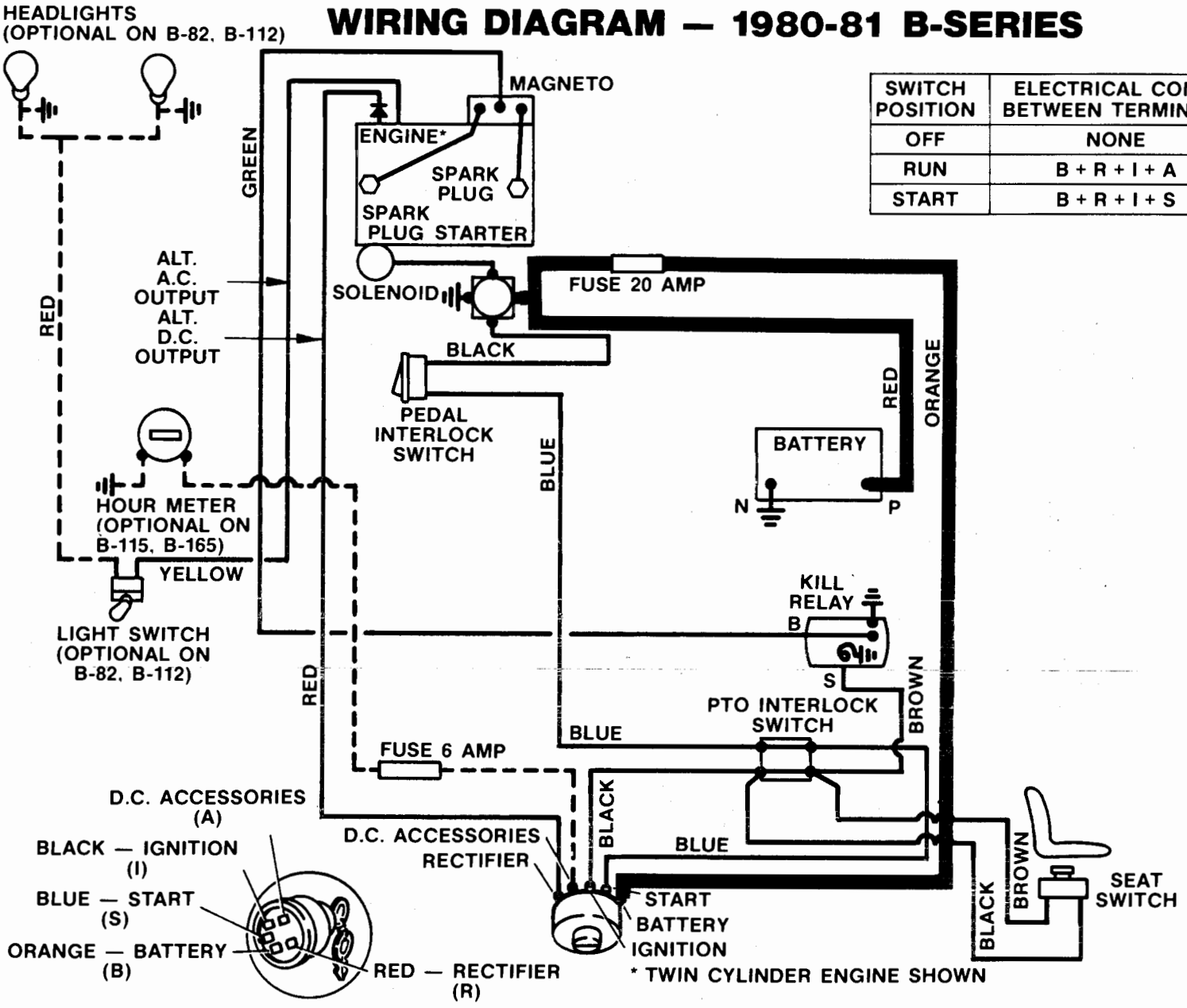


Fig. 14

WIRING DIAGRAM — 1980-81 B-SERIES

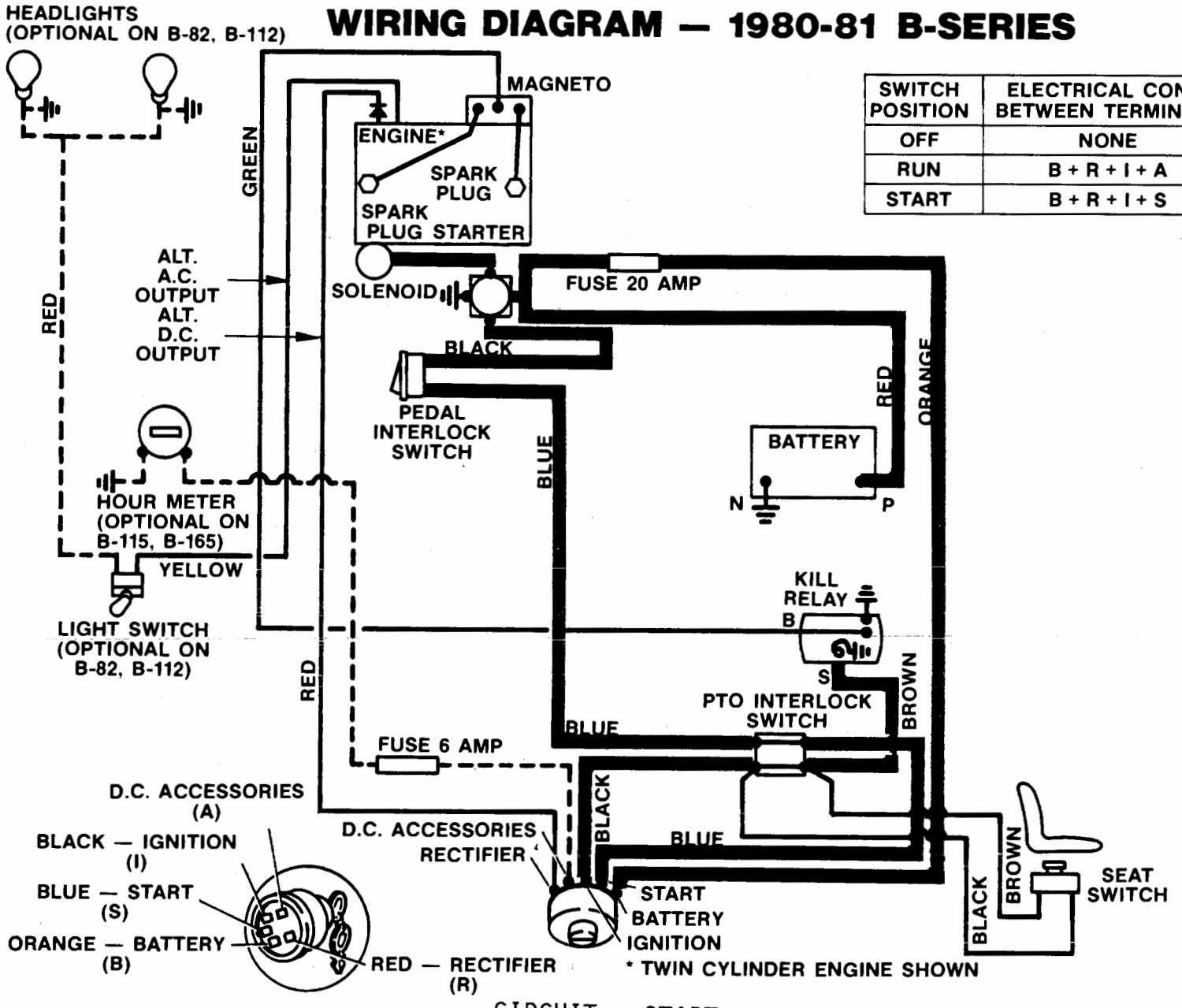


SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	NONE
RUN	B + R + I + A
START	B + R + I + S

CIRCUIT - OFF

Fig. 15

WIRING DIAGRAM — 1980-81 B-SERIES

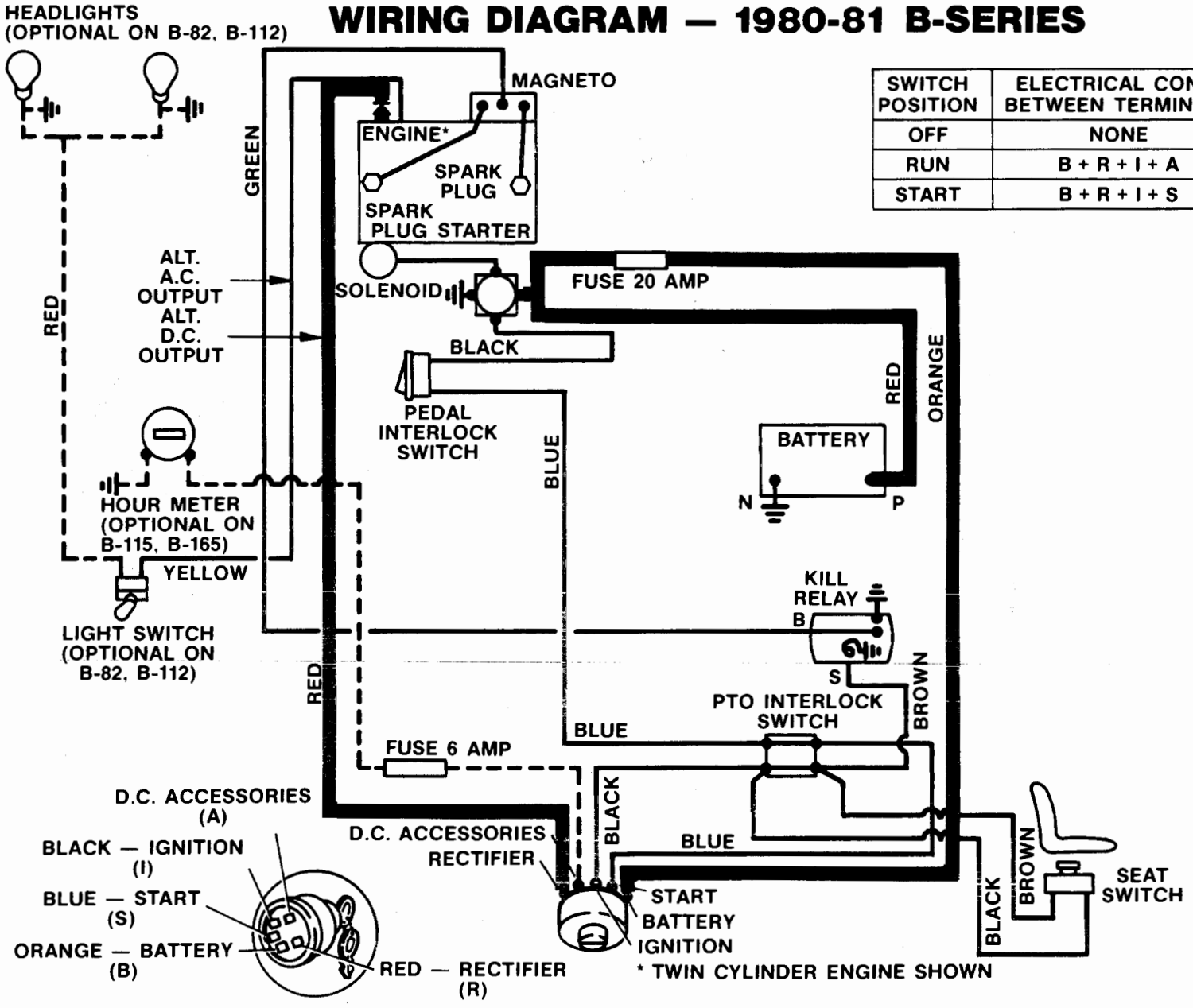


SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	NONE
RUN	B + R + I + A
START	B + R + I + S

CIRCUIT - START

Fig. 16

WIRING DIAGRAM — 1980-81 B-SERIES

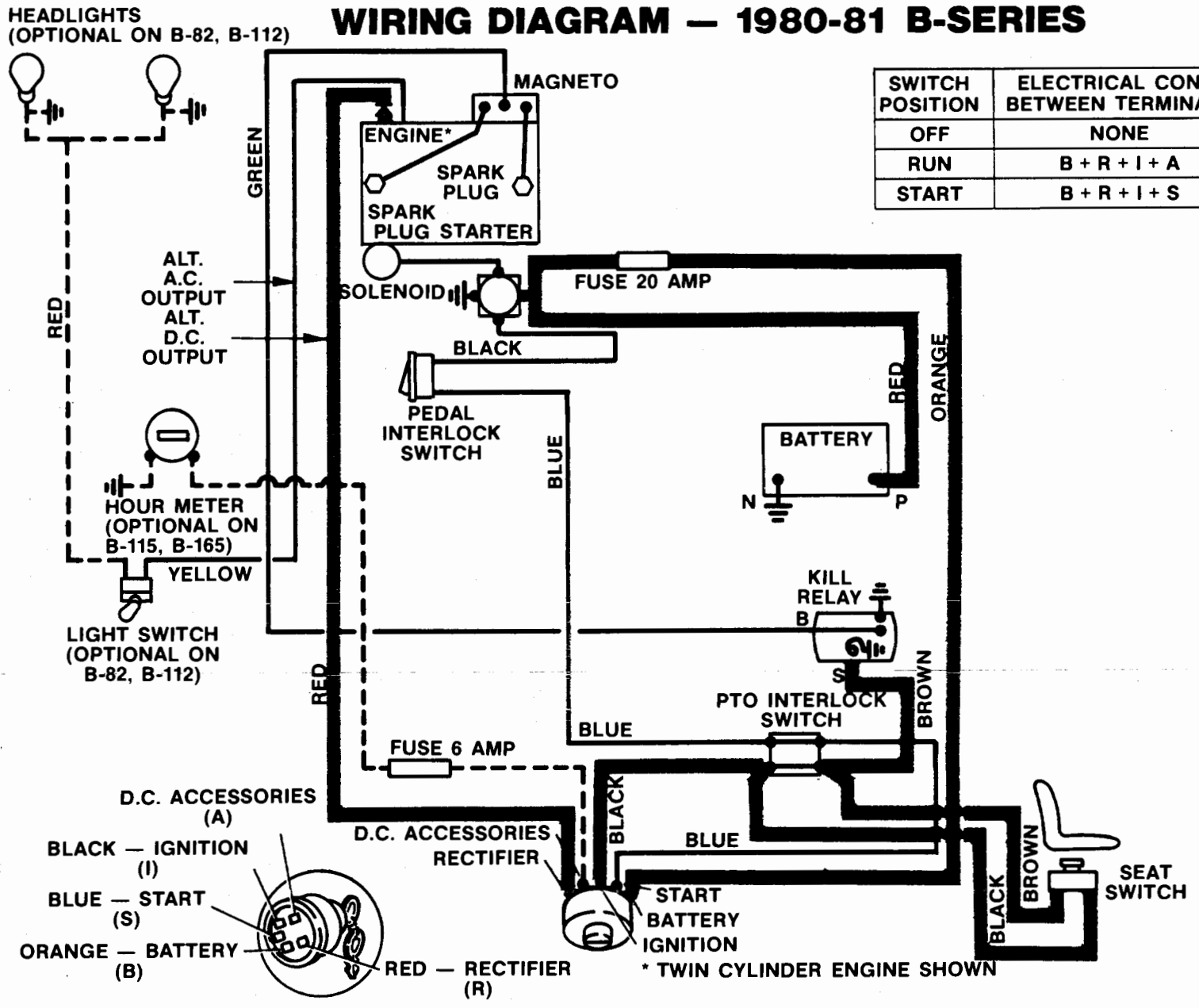


SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	NONE
RUN	B + R + I + A
START	B + R + I + S

CIRCUIT - CHARGING

Fig. 17

WIRING DIAGRAM — 1980-81 B-SERIES

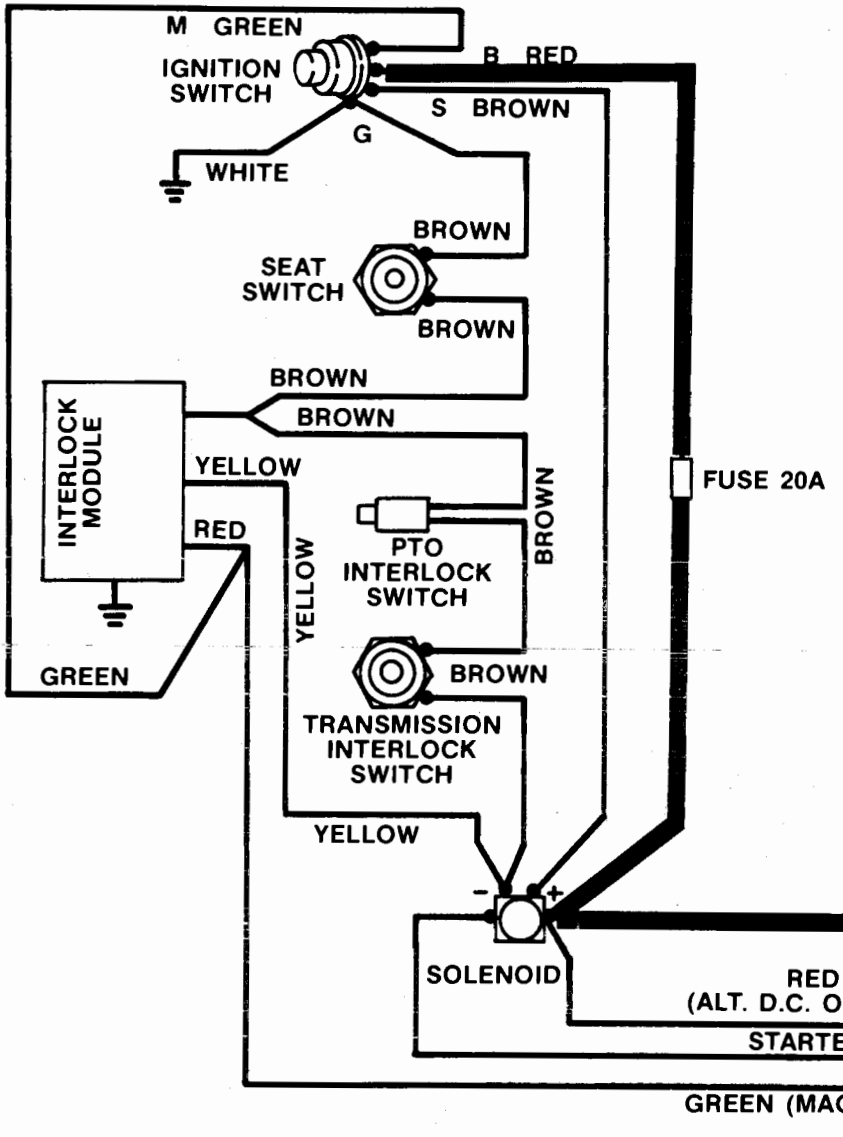


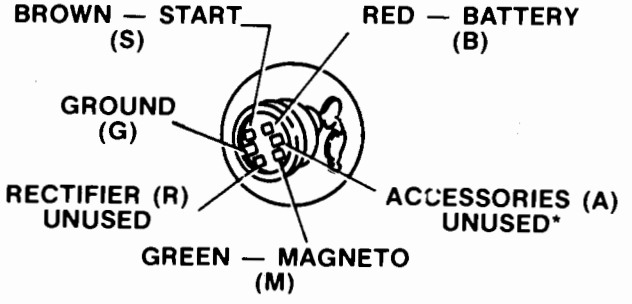
SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	NONE
RUN	B + R + I + A
START	B + R + I + S

CIRCUIT - RUN WITH PTO ENGAGED

Fig. 18

WIRING DIAGRAM — 1980-82 A-111, 1982 RR-832 ELECTRIC START RIDER





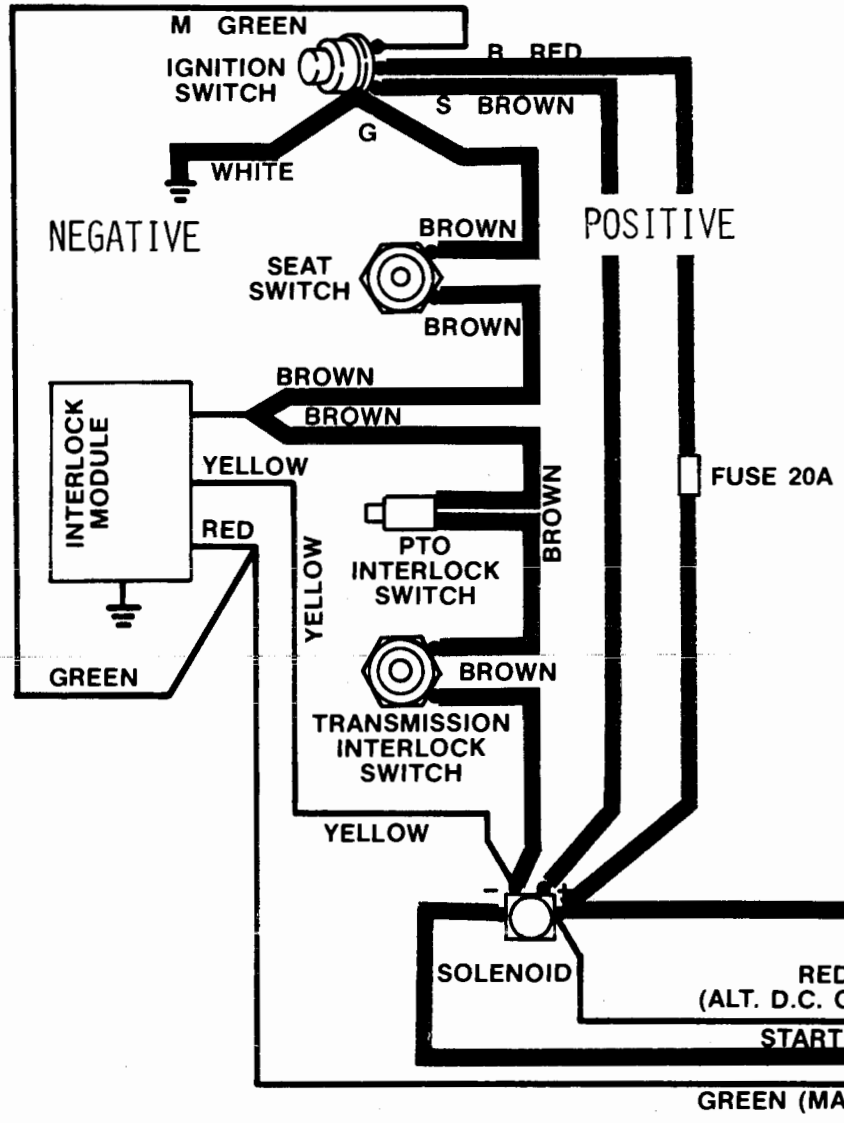
SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	G + M + A
RUN	B + R + A
START	B + S

* ENGINE CHARGING SYSTEM IS NOT DESIGNED FOR ACCESSORY OPERATION

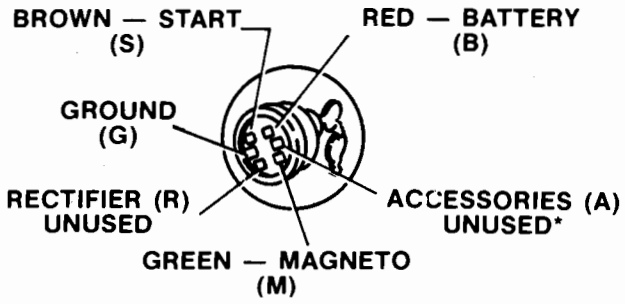
CIRCUIT - OFF

Fig. 19

WIRING DIAGRAM — 1980-82 A-111, 1982 RR-832 ELECTRIC START RIDER



CIRCUIT - START

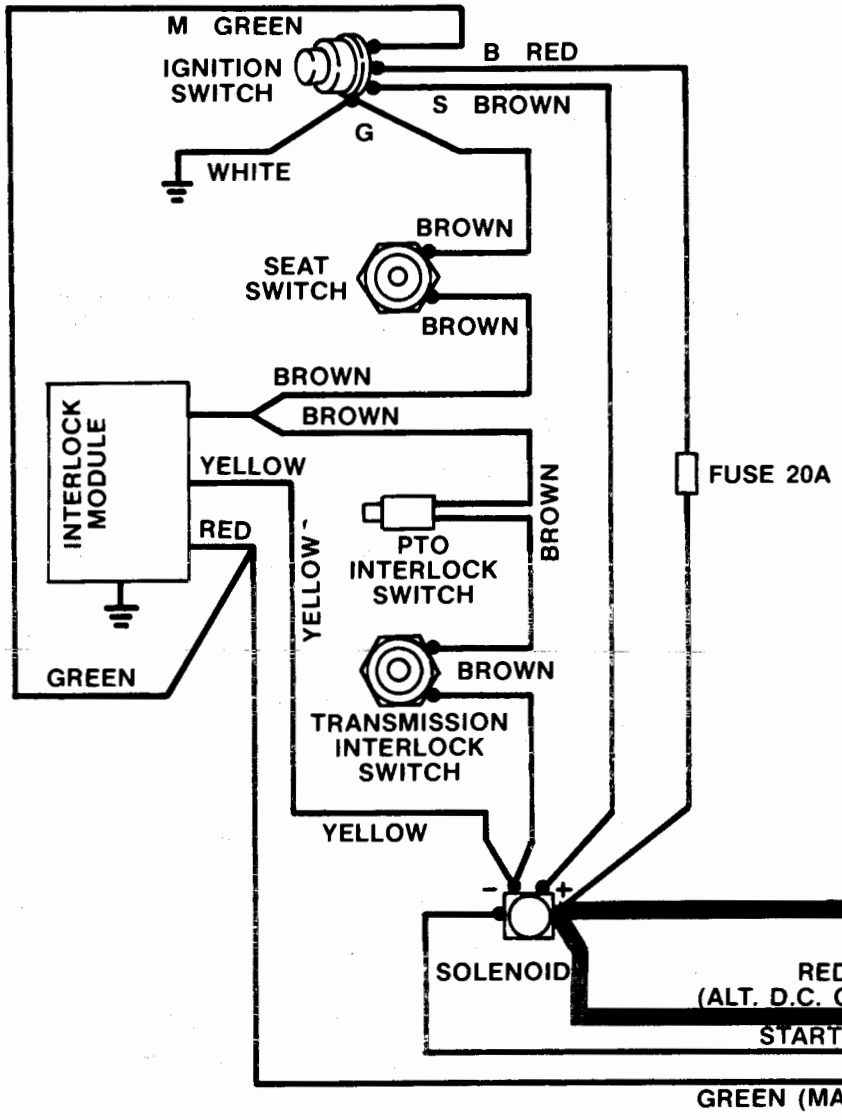


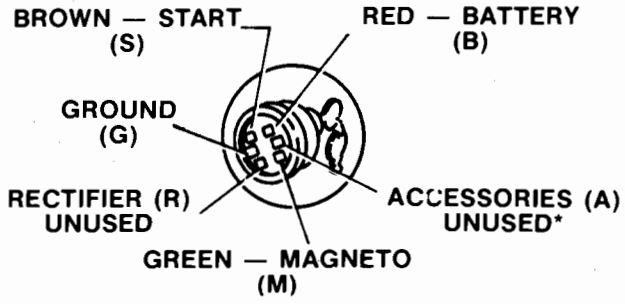
SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	G + M + A
RUN	B + R + A
START	B + S

* ENGINE CHARGING SYSTEM IS NOT DESIGNED FOR ACCESSORY OPERATION

Fig. 20

WIRING DIAGRAM — 1980-82 A-111, 1982 RR-832 ELECTRIC START RIDER





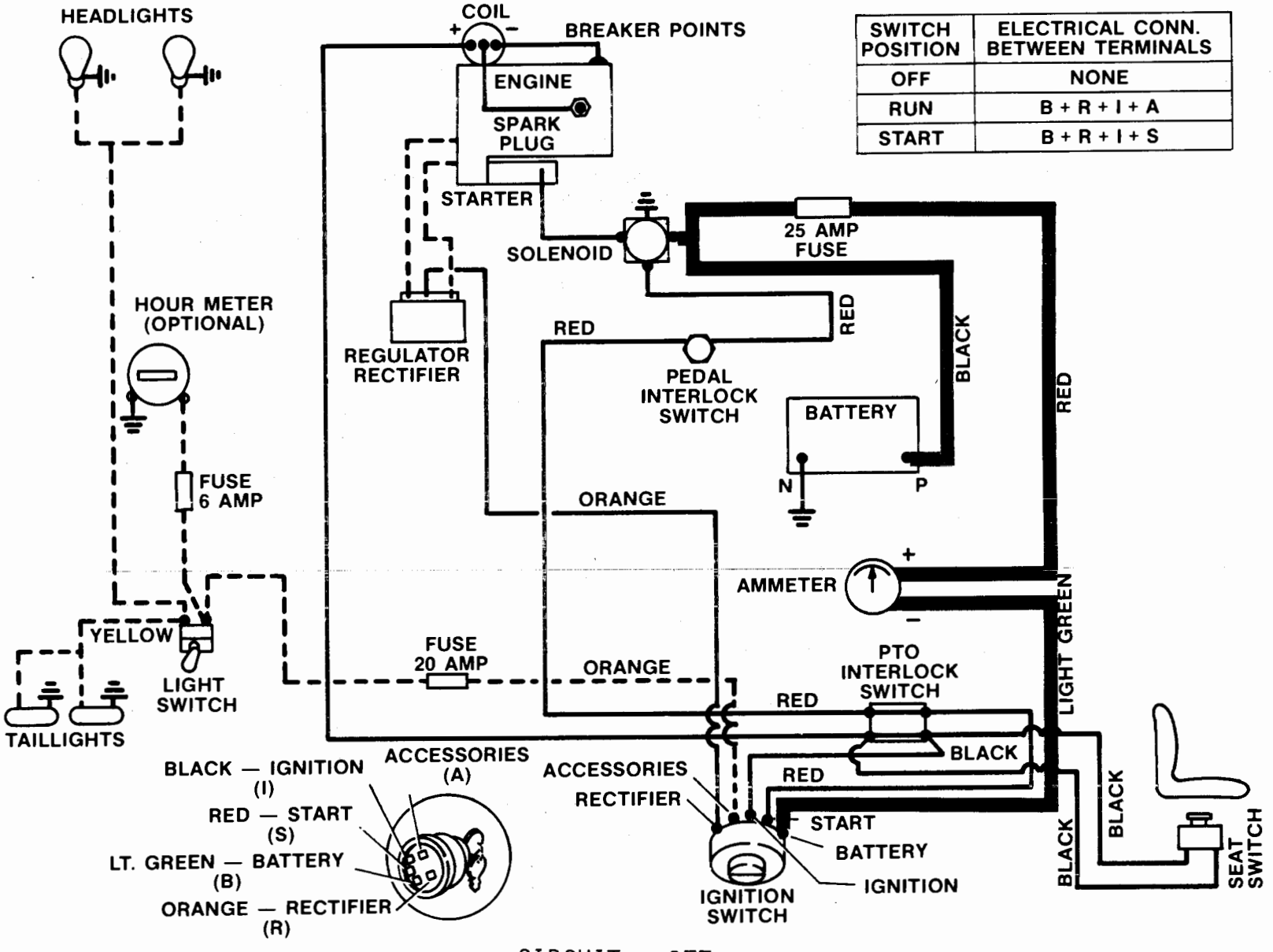
SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	G + M + A
RUN	B + R + A
START	B + S

* ENGINE CHARGING SYSTEM IS NOT DESIGNED FOR ACCESSORY OPERATION

CIRCUIT - CHARGING

Fig. 21

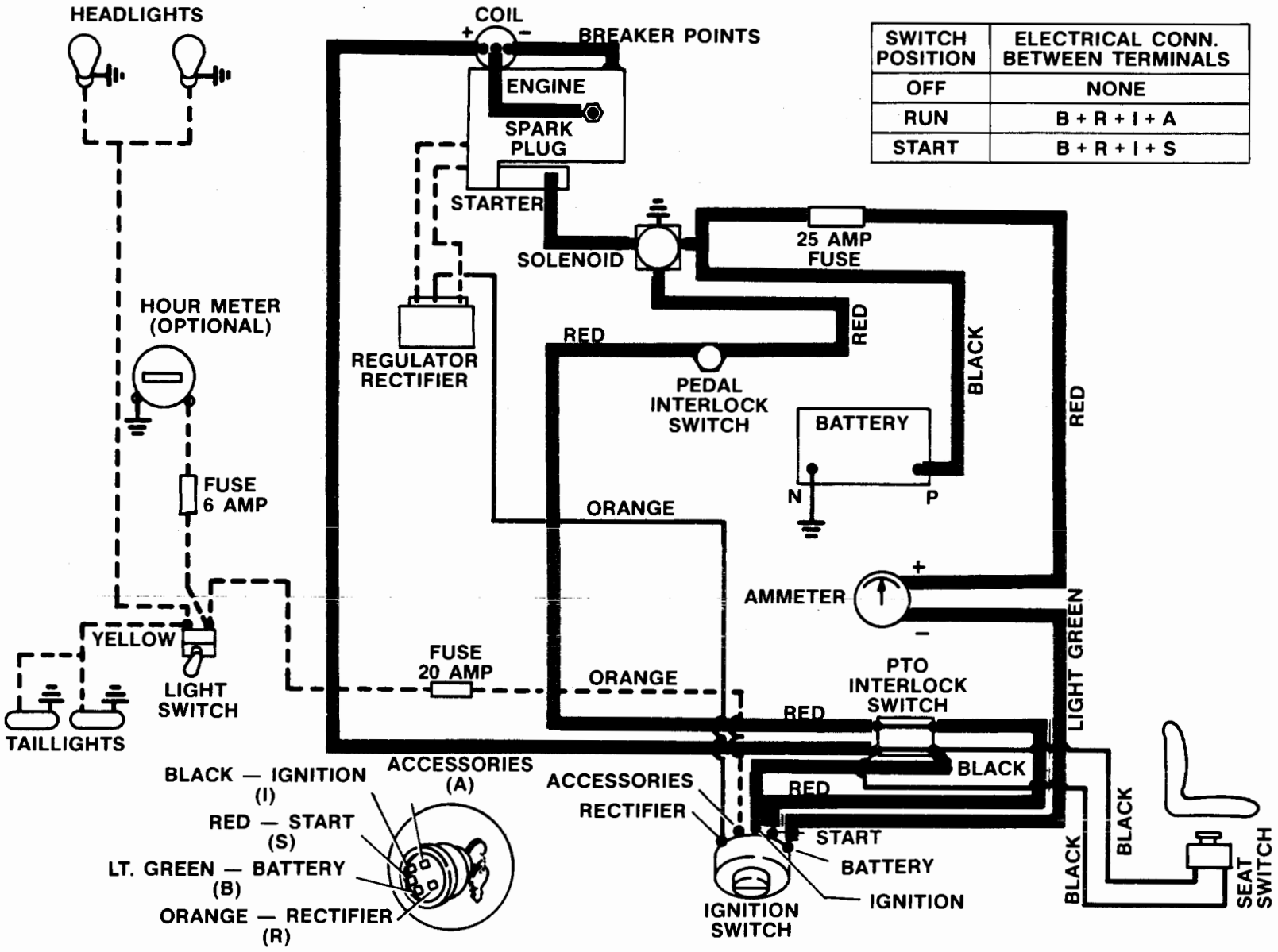
WIRING DIAGRAM — 1978-81 C-SERIES



SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	NONE
RUN	B + R + I + A
START	B + R + I + S

CIRCUIT - OFF

WIRING DIAGRAM — 1978-81 C-SERIES

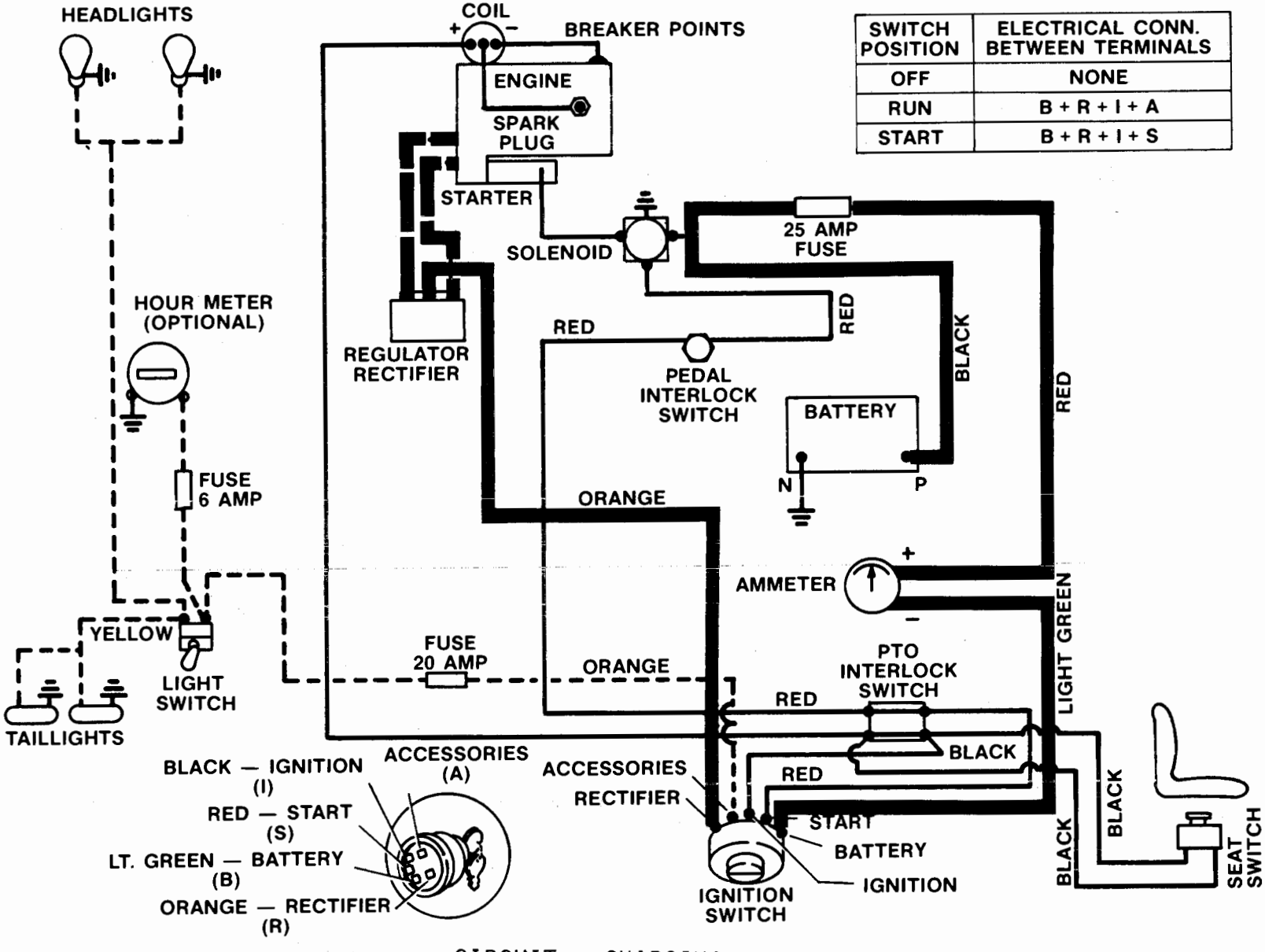


SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	NONE
RUN	B + R + I + A
START	B + R + I + S

CIRCUIT - START

Fig. 23

WIRING DIAGRAM — 1978-81 C-SERIES

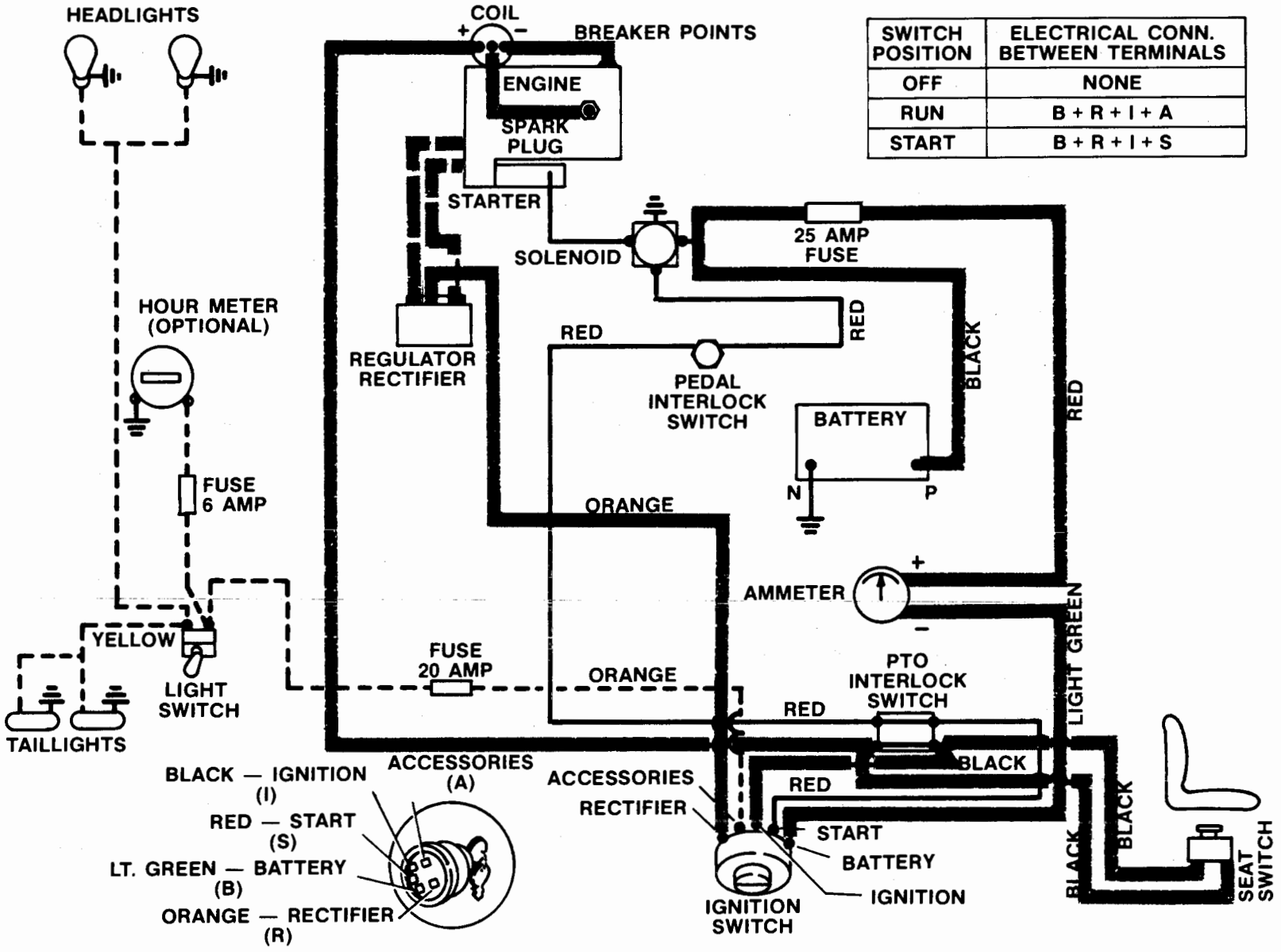


SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	NONE
RUN	B + R + I + A
START	B + R + I + S

CIRCUIT - CHARGING

Fig. 24

WIRING DIAGRAM — 1978-81 C-SERIES

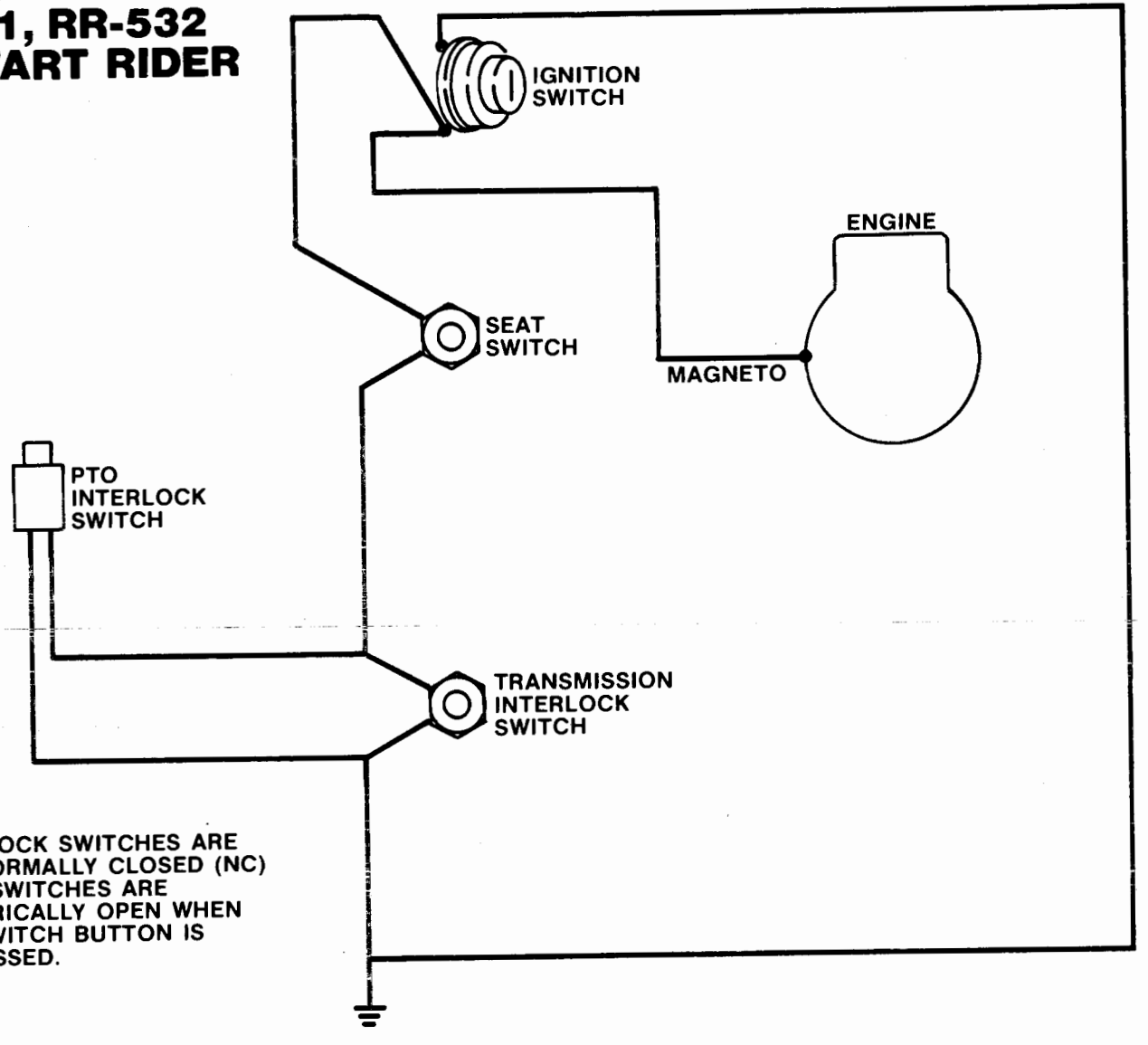


SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	NONE
RUN	B + R + I + A
START	B + R + I + S

CIRCUIT - RUN WITH PTO ENGAGED

Fig. 25

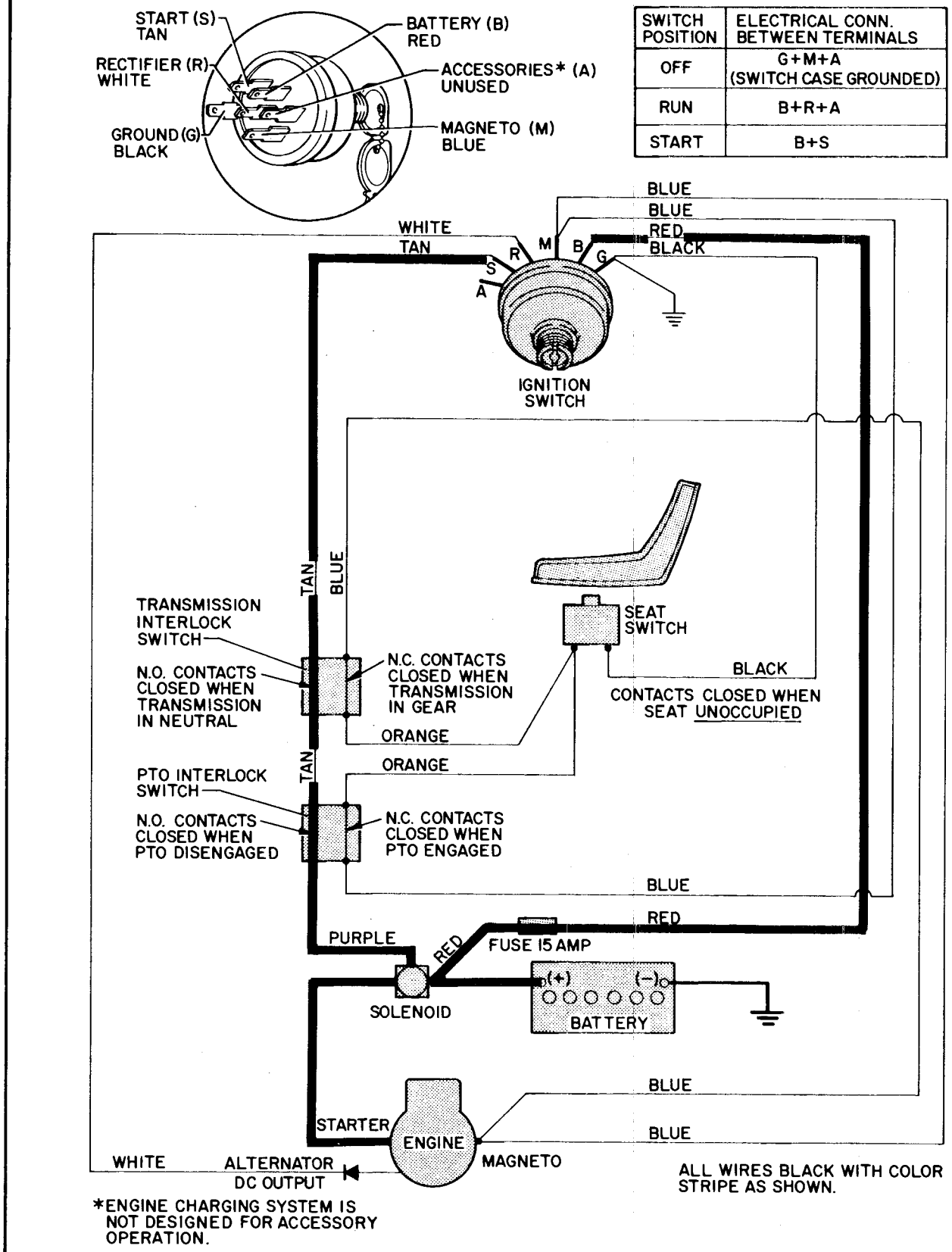
WIRING DIAGRAM — 1982 A-51, RR-532 RECOIL START RIDER



NOTE: INTERLOCK SWITCHES ARE THE NORMALLY CLOSED (NC) TYPE; SWITCHES ARE ELECTRICALLY OPEN WHEN THE SWITCH BUTTON IS DEPRESSED.

Fig. 26

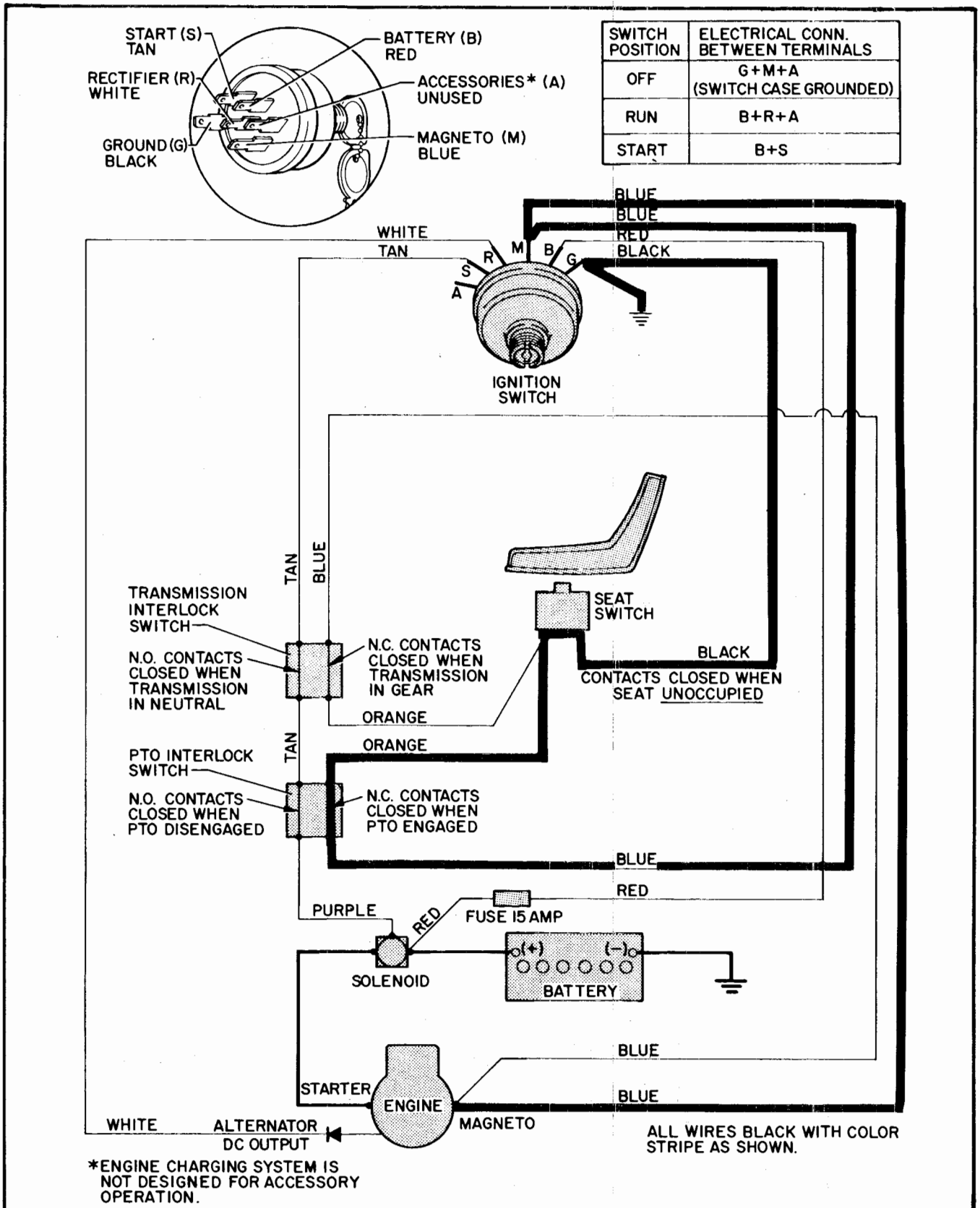
1983 A-SERIES



WHEEL HORSE lawn & garden tractors

START CIRCUIT

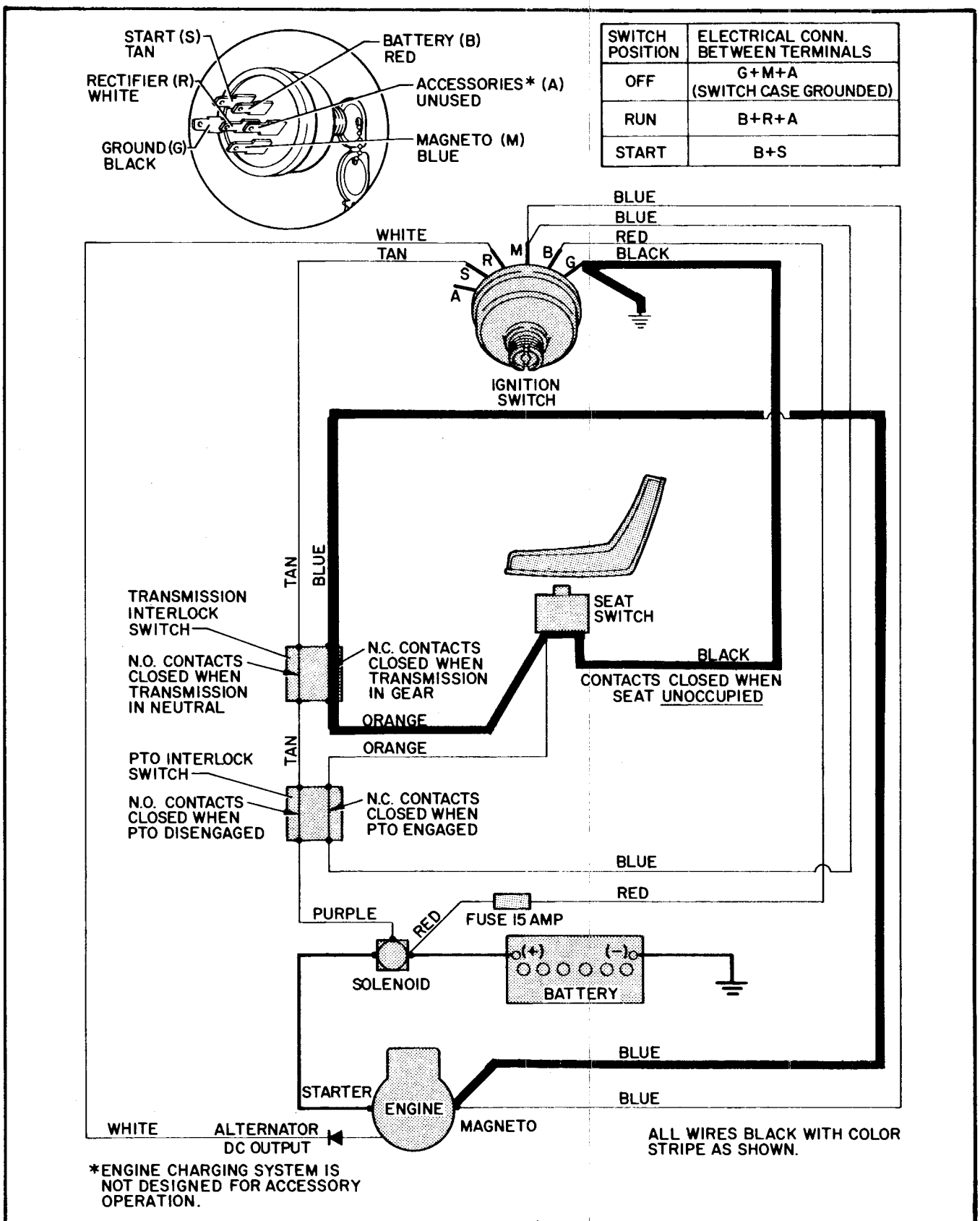
1983 A-SERIES



WHEEL HORSE lawn & garden tractors

KILL CIRCUIT - PTO ENGAGED

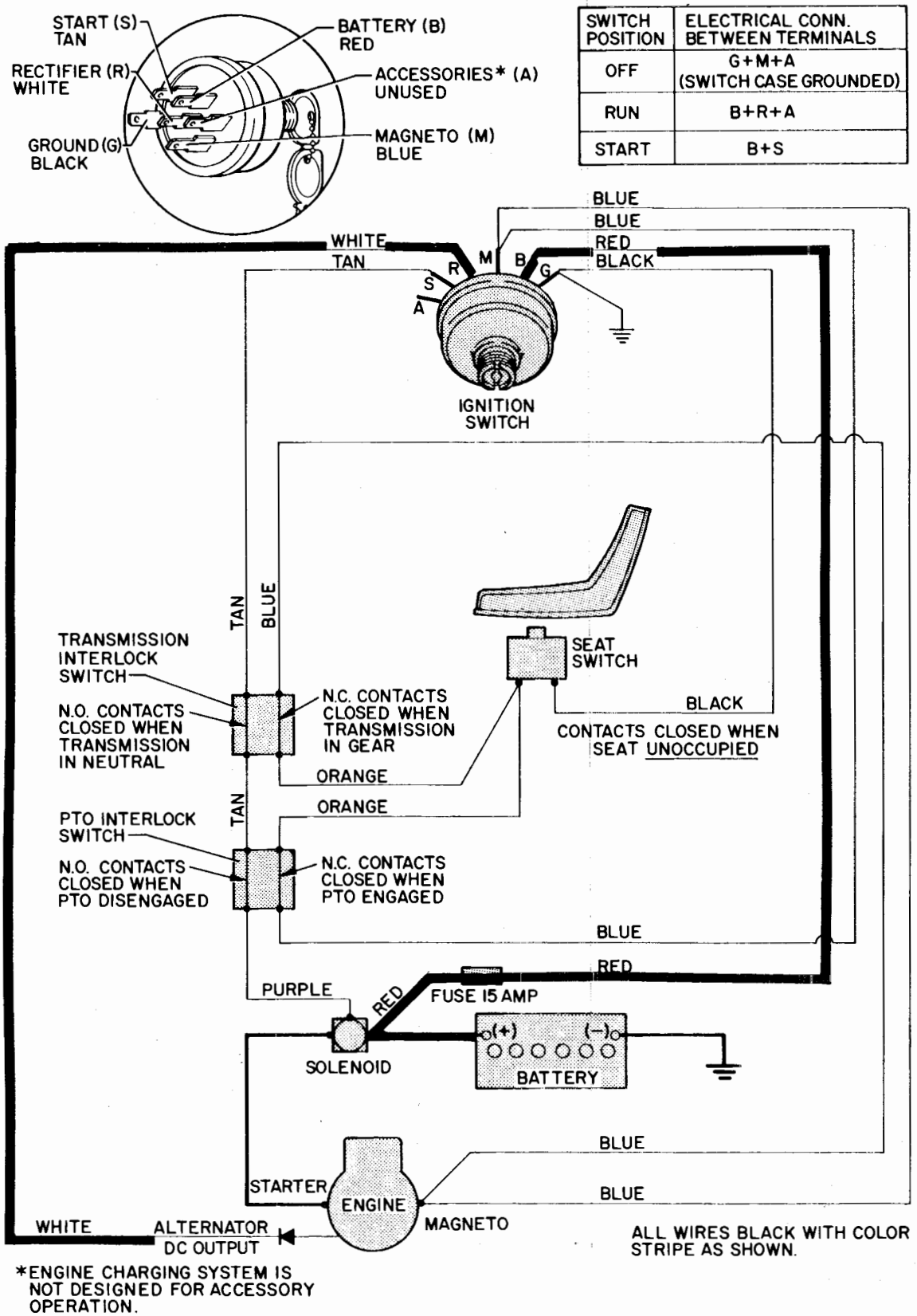
1983 A-SERIES



WHEEL HORSE
lawn & garden tractors

KILL CIRCUIT - TRANS. IN GEAR

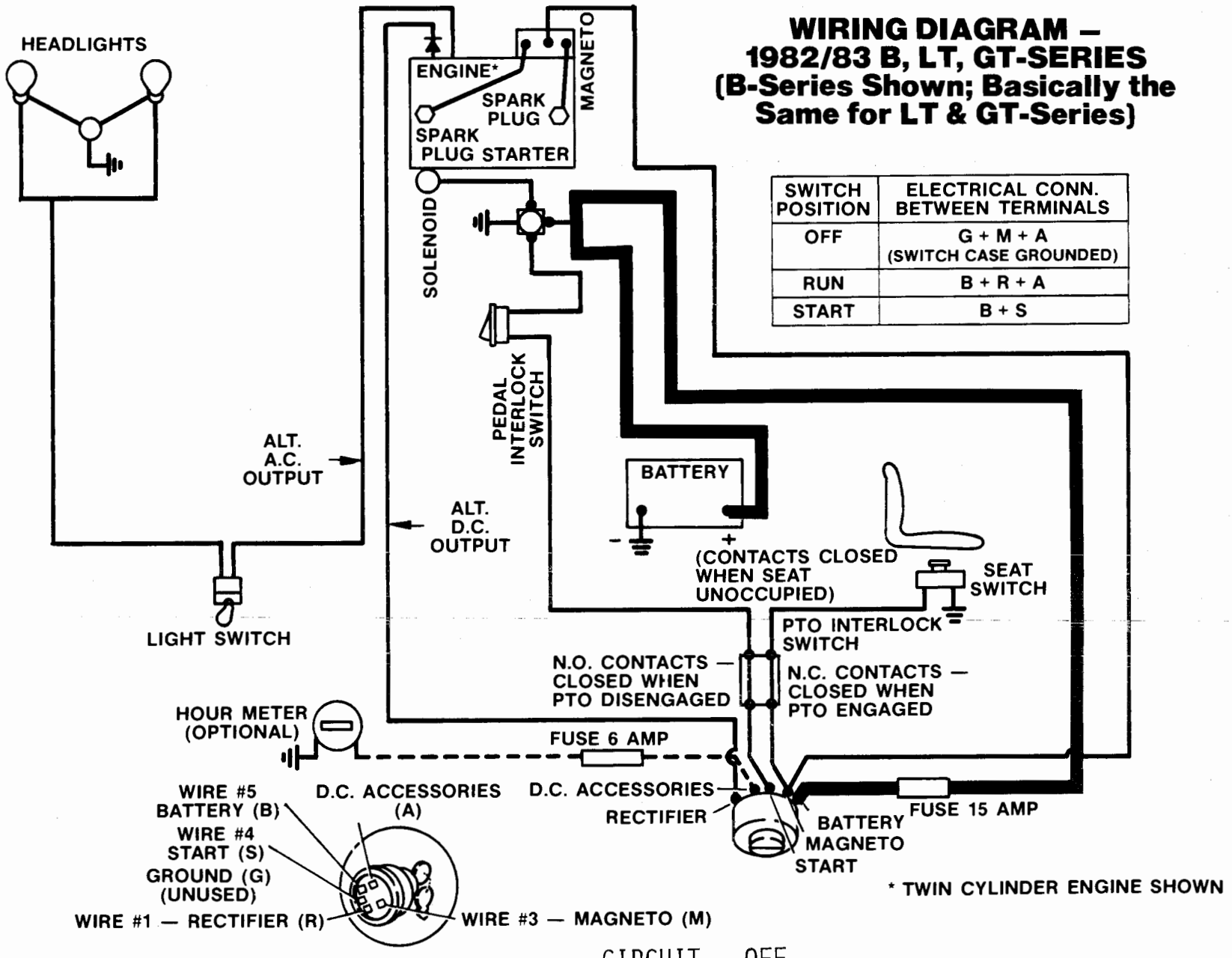
1983 A-SERIES



*ENGINE CHARGING SYSTEM IS NOT DESIGNED FOR ACCESSORY OPERATION.

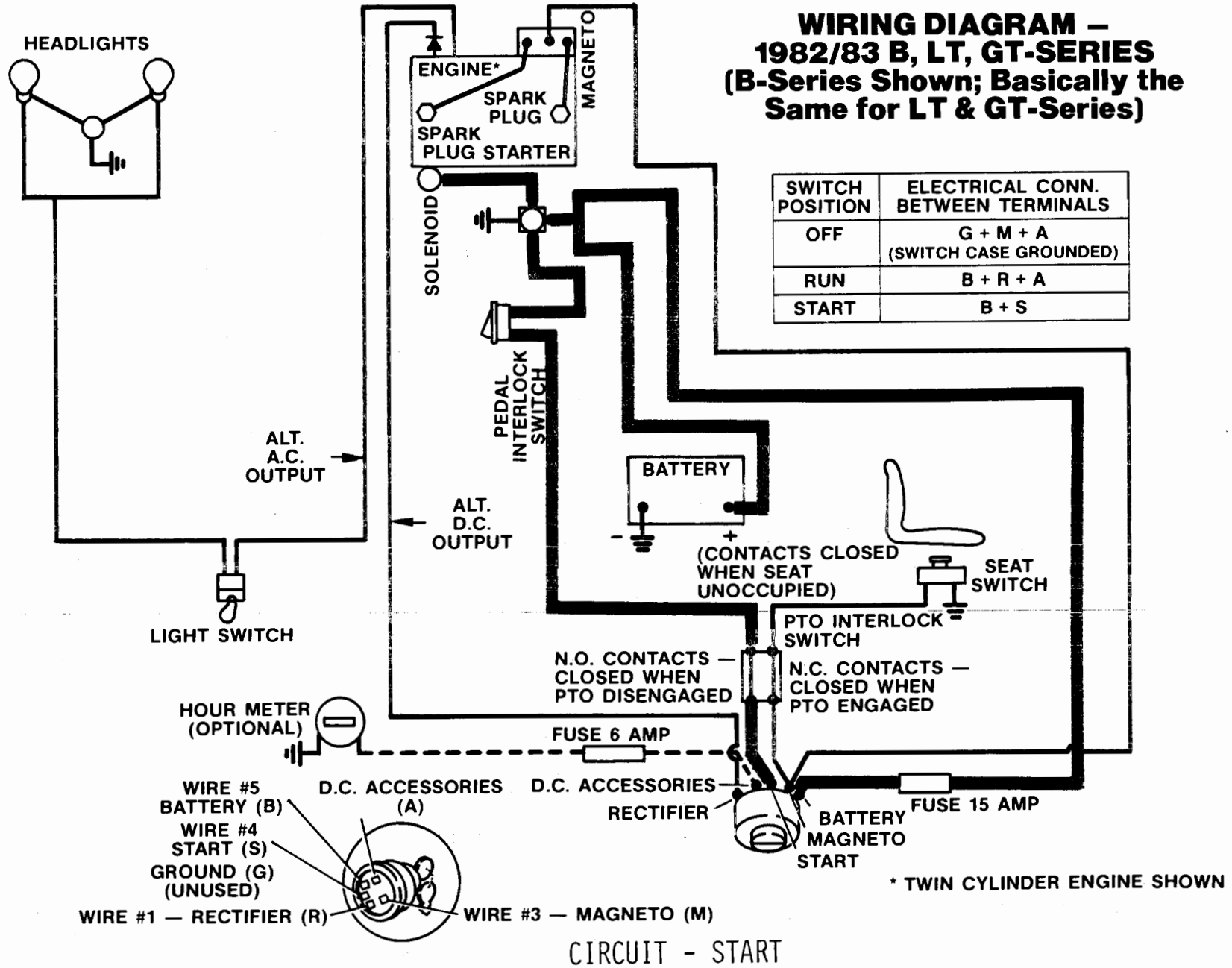
WHEEL HORSE lawn & garden tractors

CHARGING CIRCUIT



SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	G + M + A (SWITCH CASE GROUNDED)
RUN	B + R + A
START	B + S

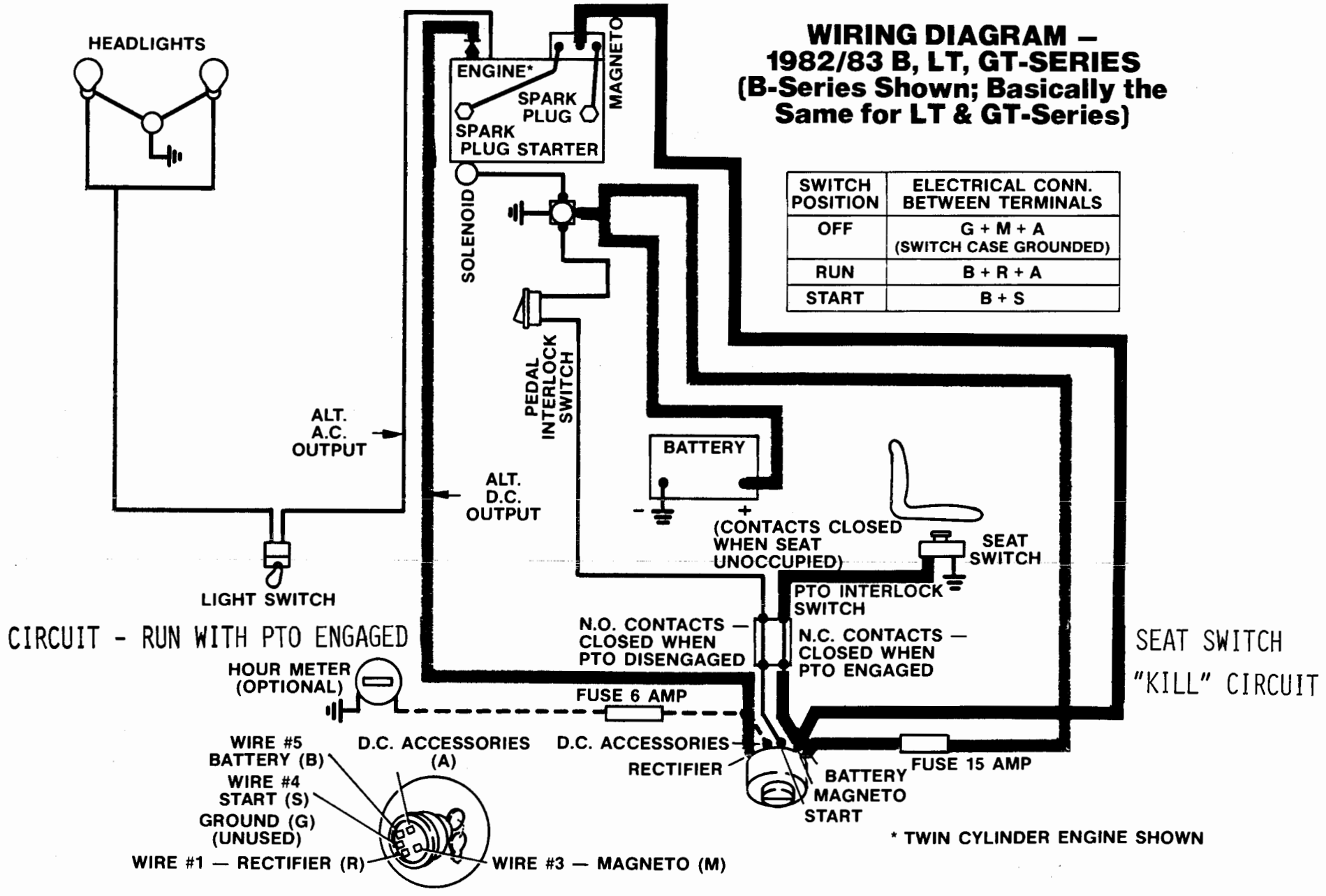
Fig. 27



SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	G + M + A (SWITCH CASE GROUNDED)
RUN	B + R + A
START	B + S

CIRCUIT - START

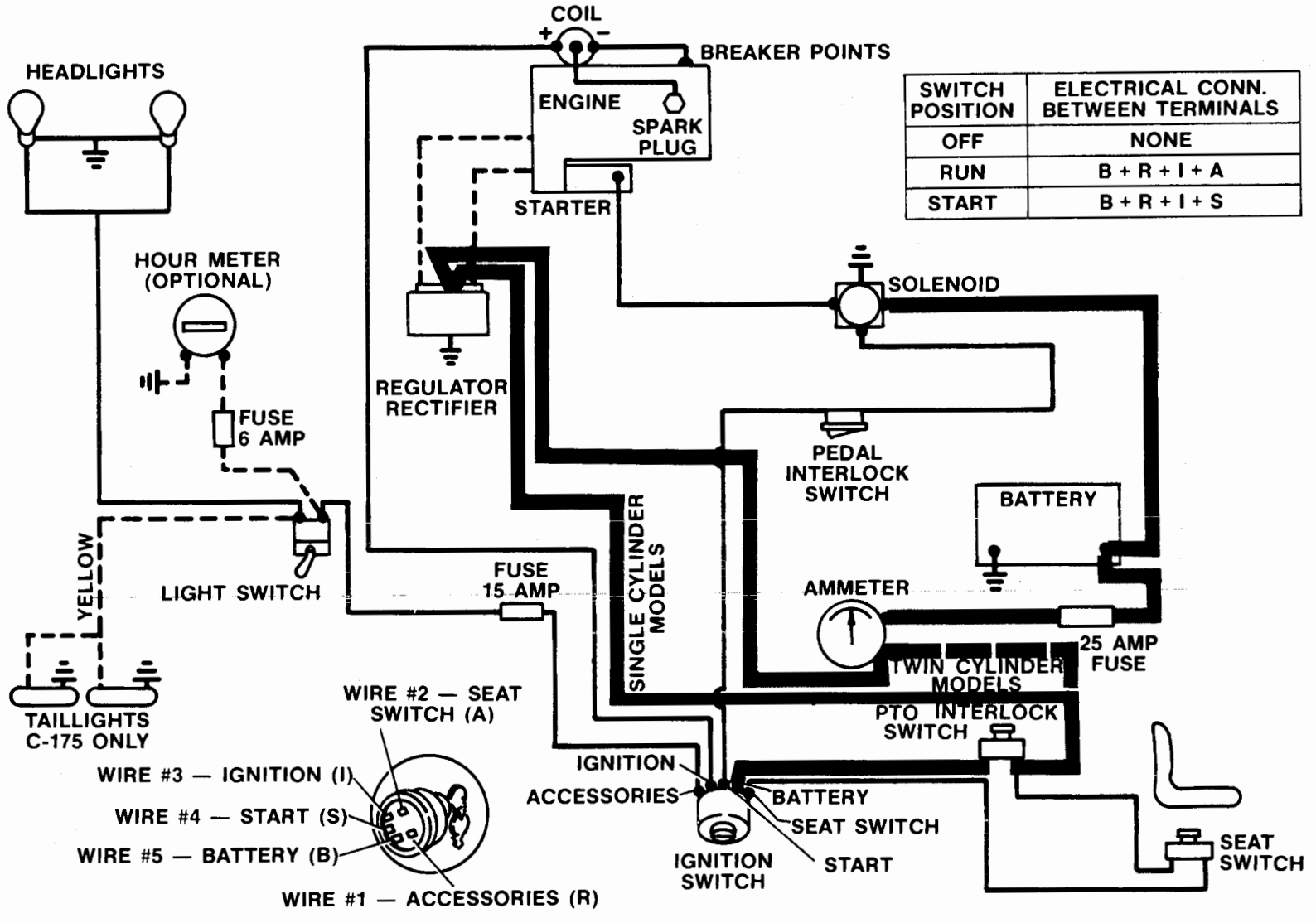
Fig. 28



SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	G + M + A (SWITCH CASE GROUNDED)
RUN	B + R + A
START	B + S

Fig. 29

WIRING DIAGRAM – 1982/83 C-Series

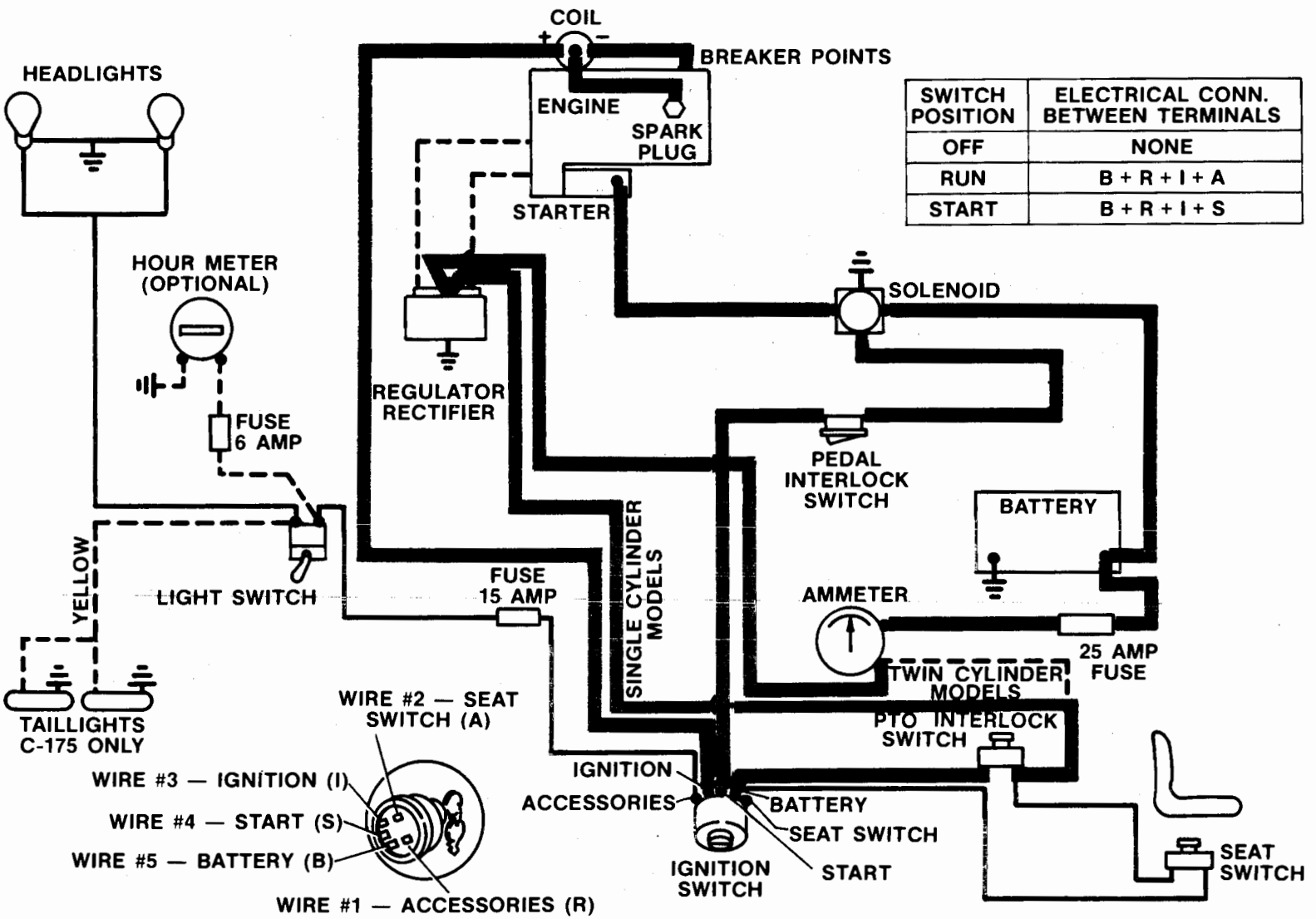


SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	NONE
RUN	B + R + I + A
START	B + R + I + S

CIRCUIT - OFF

Fig. 30

WIRING DIAGRAM — 1982/83 C-Series

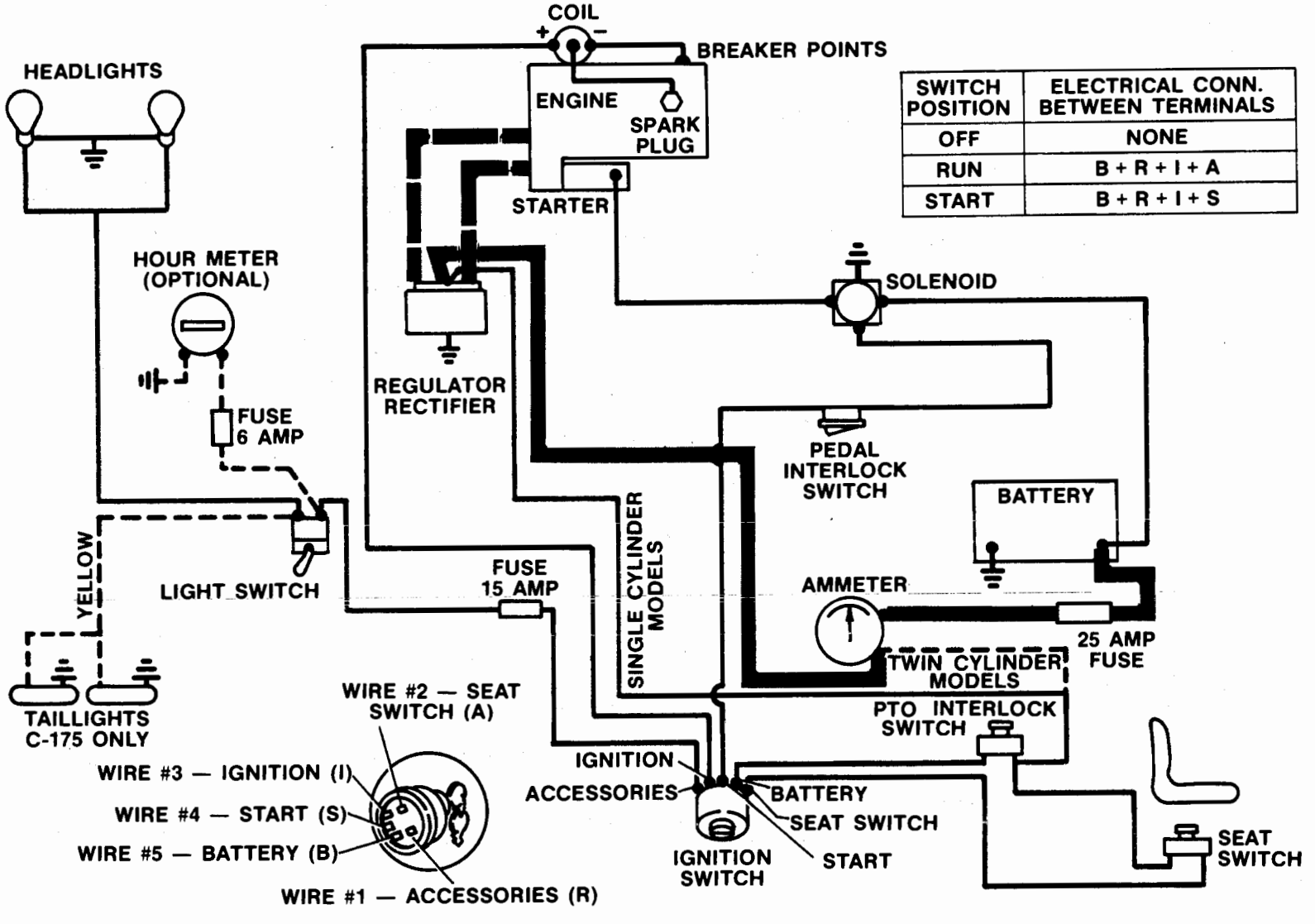


SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	NONE
RUN	B + R + I + A
START	B + R + I + S

CIRCUIT - START

Fig. 31

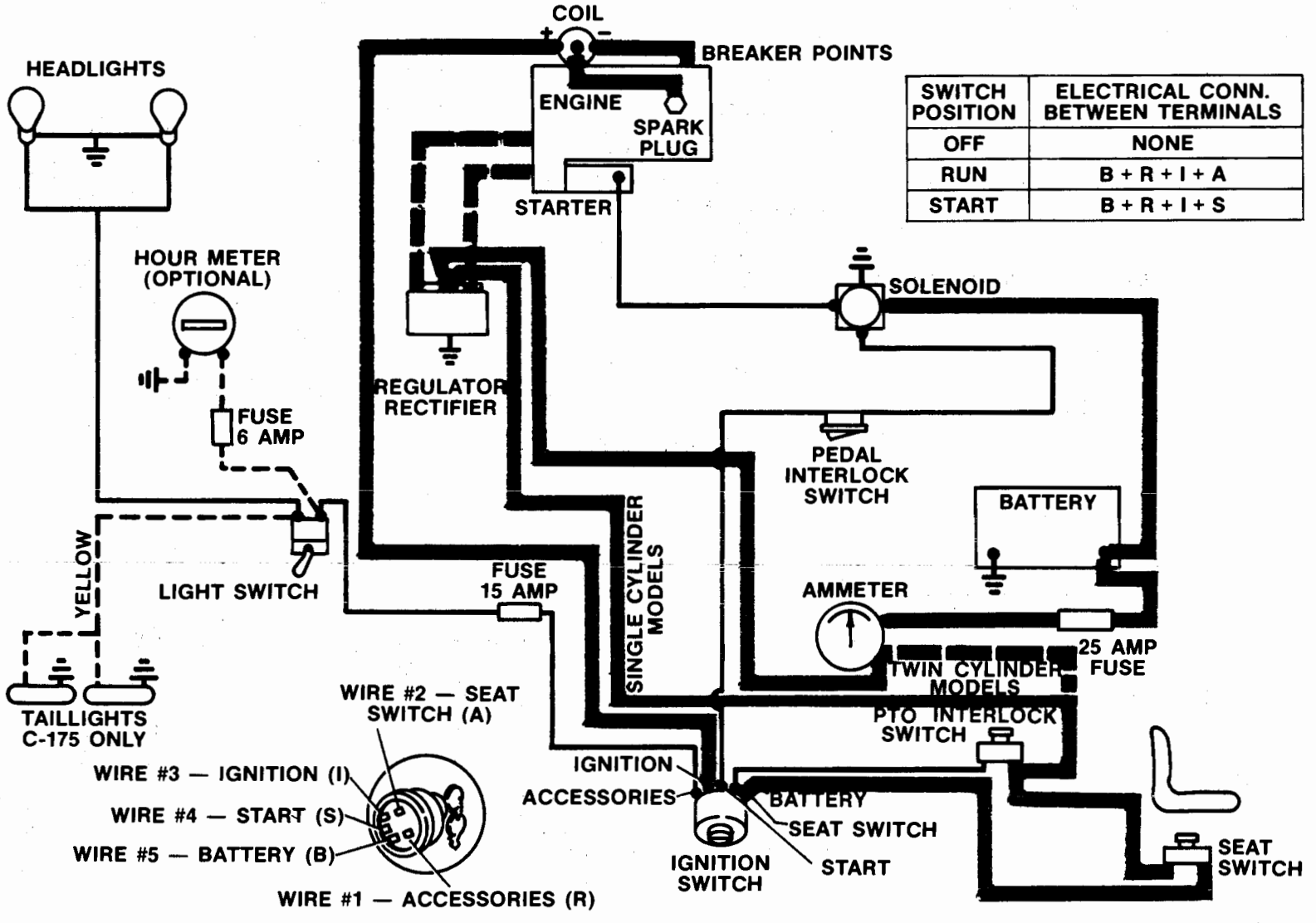
WIRING DIAGRAM — 1982/83 C-Series



SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	NONE
RUN	B + R + I + A
START	B + R + I + S

CIRCUIT - CHARGING

WIRING DIAGRAM — 1982/83 C-Series



SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	NONE
RUN	B + R + I + A
START	B + R + I + S

CIRCUIT - RUN WITH PTO ENGAGED

Fig. 33

SECTION V - TROUBLE-SHOOTING EXAMPLES

PROBLEM 1: Customer Complaint - Every time he uses his C-85 (1981) tractor it won't start. He has to put jumper cables on the battery and jump start the tractor.

Fig. 34

STEP 1: Visually Inspect All Connections:

A. Blown Fuse
B. Loose or Broken Wires

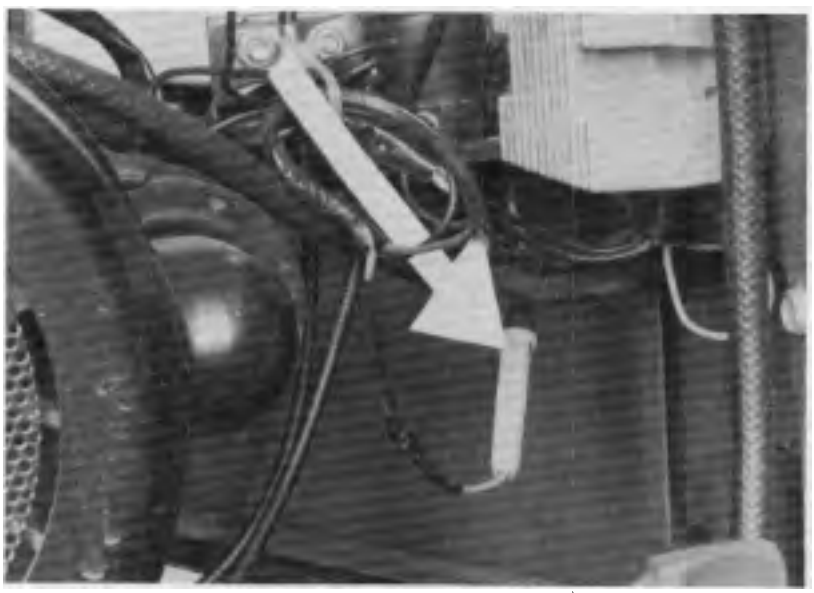


Fig. 35

Step 2: Check the Battery

A. Visual inspection
B. Charge the battery
C. Hydrometer test

Fig. 36

Step 3: If battery checks out OK and tractor will now start with fully charged battery - check the following:

A. Start unit and check charging systems

1. Ammeter for Charge

Fig. 37

Step 4: If no charge indicated at the Ammeter, check voltage at battery terminals - with the engine running at 3/4 to full throttle, D.C. voltage should show increase to approximately 14 volts D.C.

Fig. 38

Step 5: No voltage increase - unplug the rectifier/ regulator - with the meter set for A.C. current the meter should read around 28 volts AC -

- if less than 28 volts A.C. - Defective stator, replace.

- if more than 28 volts A.C. - Defective rectifier/regulator, replace with new unit.

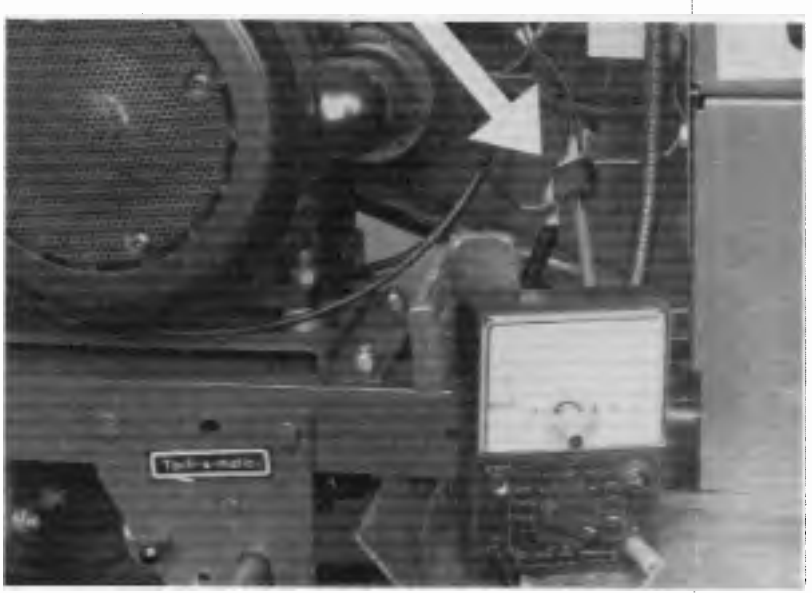


Fig. 39

PROBLEM 2: Customer Complaint - 1981 GT-2500 Anniversary Special - the engine cranks over but won't start. After some investigation you find the battery is in good condition.

Fig. 40

Step 1: Always check the obvious -

A. Blown Fuse
B. Loose or Broken Wire Connection

Fig. 41

Step 2: Unplug the magneto wire from the engine and try starting.

A. If the unit starts continue on to Step 3.

NOTE - Remember you will have to reconnect the magneto wire to kill the engine.

B. If it doesn't start, the problem is with the engine, not the wiring harness.

1. Check the engine for spark - if spark, there is some carburetor or mechanical problem.

2. If no spark - check breaker points and magneto.

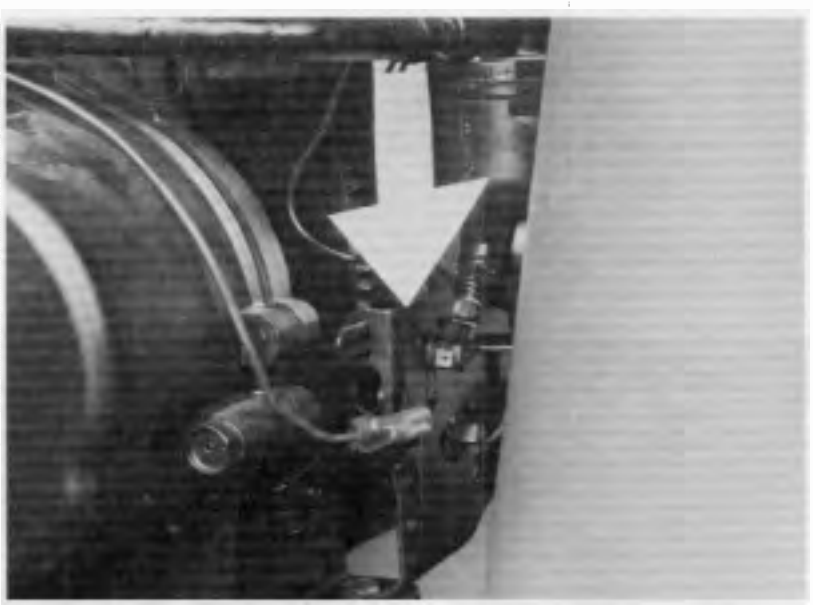


Fig. 42

Step 3: If the engine started with the magneto wire removed, we have to assume we are having problems in our kill relay circuit. First connect a test light or meter to the black wire located on the ignition switch (I-terminal). Try starting the unit. If we show voltage continue to Step 4.

Fig. 43

Step 4: Inspect the connections to the kill relay and PTO interlock switch. Make sure the kill relay has a good ground.

Fig. 44

Fig. 45

Step 5: Connect a test light or meter to the kill relay (s terminal violet wire) try starting the unit, if you show current - replace the kill relay switch.

Fig. 46

Product information and specifications are shown herein as of the time of printing. Wheel Horse Products, Inc. reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligation.

WHEEL HORSE
lawn & garden tractors

WORK HORSE
by Wheel Horse